Report of the Literature Review Committee

Annual Review of the Literature on Fats, Oils and Detergents. Part I.

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INTRODUCTION

As in previous years, the review of the literature for 1964 was gathered and compiled from current original publications as well as from the abstracts of publications for which originals were not available. The review deals with various diversified aspects of the fats and oils field, varying from technology to metabolism. The year under review saw notable developments in the detergent field. Industry launched its voluntary program of shifting from the alkylbenzene sulfonate to linear alkylate sulfonate detergents to avert a nation-wide flood of foam menacing America's potable water supply. Some exciting developments have taken place toward elucidating possible functions of essential fatty acids, as a result of the discovery of the prostaglandins. The confused and uncertain state of knowledge regarding the relationship between dietary fats and vascular diseases persists. A great deal of interest has been shown on the nutritional value of heated fats. On the analytical side, NMR and mass spectrometry are becoming increasingly important tools in the fat and oil field. These, by no means, are the only important developments; but certainly the most prominent ones.

SOAPS, SURFACTANTS AND DETERGENTS

MANUFACTURE AND PROCESSES

Sulfonation. The batch, Ballestra, Chemithon, Allied Chemical and SO_2–SO_3 processes are discussed (Carasik and Hughey, *Soap Chem. Specialties 40* (6), 49). Continuous sulfonation processes for ABS are described (Herold, *Ger. 1,150,673*; Silvis and Ballestra (*JAOCS 40*, 618). Selectivity of sulfation toward completion depends upon the concentration of spent sulfuric acid (Reznikov and Kurasova, *Tr. Nauchn.-Issled. Inst. Sintetich. Zhirozamenitelei i Moyouschchikh Sredstv 3*, 9). Aminosulfuric acid in pyridine tended to preserve the double bond in fatty alcohols during sulfonation (Hell and Vyskocil, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963* (2), 13). Maximum degree of double bond sulfation with di- and triethanolamine reaction products of oleic acid occurs at 40 to 60C and 100% excess sulfuric acid (Zajic and Kahovcova, *J. Inst. Chem. Technol. Prague 6–1*, 265). A gaseous mixture of 2.5 to 10% sulfur trioxide was used to sulfonate fatty alcohols or AB (Vahala et al., *Czech. 109,490*). An apparatus designed to sulfonate fatty acids or AB with oleum or sulfur trioxide was claimed (Ballestra, *Ital. 631,173*).

Nonsulfonatable material was removed from phenylalkanes by using urea in hexane (Kubias, *Czech. 110,477*). Slightly colored alkyl- or cycloalkylsulfonates were obtained with chlorosulfonation followed by saponification and evaporation of the solution containing an alkali metal sulfite, thiosulfate or dithionite, in turn by treatment with sodium hypochlorite (Welz, *Belg. 633,036*). Color of sulfonated fatty acid or derivatives was lightened by treatment with gaseous sulfur trioxide, then bleaching with an oxidizing agent (Wulff et al., *U.S. 3,142,691*). A method is given for the removal of Fe salts from the products of sulfation of dihydric synthetic alcohols with H_2SO_4 and further neutralization (Getmanskii, *Tr. Nauchn.-Issled. Inst. Sintetich. Zhirozamanitelei i Moyushchikh Strdstv 1960*(1), 72).

Saponification. Continuous soap manufacturing processes and equipment were described (Colgate-Palmolive Co. *Belg. 631,129*). A continuous fat splitting and soapmaking process is used to manufacture soap bars (Ladyl, *Chem. Eng. 71*(17), 106). Described was a continuous method for the production of household soap (60, 70%) (Bushuyushchii et al., *Obmen Opytorn po Nepreryvnomu Proizv. Myla, Gos. Nauchn.-Issled. Inst. Nauchn. i Tekhn. Inform. 1962*, 33). Soap manufacture for the past 20 years was reviewed up to the automatic Mazzoni process (Fock, *Chem. Age, India 15*(5), 617). A continuous TBN-2 assembly was analyzed mathematically and theoretically (Zaks and Muchnik, *Maslob.-Zjir. Prom. 30*(2), 22). Several available continuous saponification processes were reviewed (Schulerud, *JAOCS 40*, 609).

Optimum conditions for curd soap washing were methodically determined (Krnic, *Kem. Ind.* (Zagrem) *12*, 755). A process for boiling toilet soap bases was disclosed (Rubinshtein et al., *U.S.S.R. 157,035*). Some theoretical considerations of cold-process soap manufacture were made concerning the fraction of unsaponifiable fat in hydrated soap (Webb, *Soap, Perfumery, Cosmetics 33*, 68). Manufacture of soap from fatty acids was reviewed (Herrick and Jungermann, *JAOCS 40*, 615).

Saponification of crude alcohols after hydrolysis of boric esters containing fatty acids was studied (Man 'kovskaya et al., *Tr. Nauchn.-Issled. Inst. Sintetich. Zhirozamenitelei i Moyushchikh Sredstv 1961*, 50). A mathematical treatment was given of the basic equation dealing with the statics of vacuum chambers for processing soap bases (Zaks and Muchnik, *Maslob.-Zhir. Prom. 29*(10), 17). A powdered resin soap was claimed by mixing powdered resin with potassium or sodium hydroxide containing less than 70% water (Bergviks Hartsprodukter Aktiebolag. *Brit. 952,544*).

Miscellaneous Processes. Sodium sulfonates from diesel oils were obtained by saponification and oxidizing chlorination of the sulfur containing organic compounds separated from the crude (Dronov and Enikeev, *Primenenie Poverkhn.-Aktivn. Veshchestv v Neft. Prom., Ufimsk Neft. Nauchn.-Issled. Inst., Tr. Vtorogo Vses. Sovesch. 1963,* 294). A comprehensive discussion of reaction schemes, flow sheets and production statistics were given (Etroebele, *Chem.-Ingr.-Tech. 36,* 858). An economic study was presented of commercial production of hydrotrope sodium p-toluene sulfonate (Phillips, *Mfr. Chemist 34,* 575).

Reviewed were factors affecting the drying of syndets (Nevolin, *Maslob.-Zhir. Prom. 29*(10), 15). Technical problems in spray drying of washing agents were discussed including the avoidance of pyrolysis of alkyl sulfates, and viscosity control of the slurrying of alkylarylsulfonate addition (Szeplaky and Simonek, *Novenyolaj-es Haztartasi Vegyipari Kutatointezet Kozlemenyei 1961,* 25). Granular detergents similar in appearance to spray dried products were attained by an agglomeration process (Procter and Gamble Co. *Belg. 634,322*). A heat-dried detergent process comprised the hydration of a major amount of tripolyphosphate before adding the organic detergent active material (Feierstein et al., *U.S. 3,133,024*).

A technical scheme is given for manufacture of alkylarenesulfonates from a refined shale tar fraction (Voore et al., *Sintetich Moyshchie Veshchestva iz Slantsevoi Smoly. Akad. Nauk. Est. SSR. Inst. Khim. 1964,* 207). A discussion is given of polymerization of propylene tetra and pentamers, their purification, and use for continuously alkylating benzene. Continuous sulfonation by sulfur trioxide in several processes is given (Potolovskii et al., *Tr. Vses. Nauchn.-Issled. Inst. po Perarabotke Nefti* No. *9,* 110).

RAW MATERIALS

Light fractions of shale tar can be used to synthesize alkylarenesulfonates and secondary alkyl sulfates (Faingol'd et al., *Sintetich, Noyuschie Veshchestva iz Slantsevoi Smoly, Akad. Nauk Est. SSR, Inst. Khim. 1964,* 94). Alkyl sulfates were prepared from crude paraffin (Tonkoshurov et al., *Tr. Kuibyshevsk. Gos Nauchn.-Issled. Inst. Neft. Prom. 1962*(16), 83). Sulfated and sulfonated products were obtained using cracking distillate boiling 150 to 250C and 250 to 350C, containing 41 to 48% aromatics and olefins (Petrov, *Azerb. Neft. Khoz. 43*(2), 37). Alkanesulfonates were obtained by sulfonating soft paraffin (melting 260 to 300C) (Volkova et al., *Neftepererabotka i Neftekhim., Nauchn. Tekhn. Sb. 1964*(7), 22). Sulfonation of paraffin-free filtrate gave a satisfactory detergent (Makitra and Oleksin, *Neft. i. Gaz. Prom., Nauchn.-Tekhn. Sb. 1963* (3), 61). Ethylene chloride was reacted in a dilute solution of sodium sulfite to give sodium chloroethanesulfonate (Boboli and Kamionska, *Pol. 47,792*). Detergents of the alkylarenesulfonate type were obtained by alkylating benzene with straight chain liquid paraffins boiling 180 to 325C, the product being easily biodegradable (Rybko and Serdyukova, *Dokl. L'voosk. Politekhn. Inst. 5*(1–2), 84). Hydrocarbons from gas condensate were used to alkylate benzene and the products sulfonated (Karnaukh and Mikhailenko, *Sb. Statei o Rabotkh Ukr. Nauchn.-Issled. Inst. Maslozhir. Prom. Za 1959–1961,* Kharkiv Nos. 4–5, 82). Alkylarylsulfonates were obtained by condensing naphthas with cracked gasoline fractions in the presence of sulfuric acid (Ashimov et al., *Azerb. Neft. Khoz. 43*(4), 41). Benzene was alkylated with chlorinated diesel oil in the presence of aluminum chloride, the alkylbenzene separated and sulfonated (Mazouski and Hopfinger, *Przemysl Chem. 40,* 509).

Olefins from various sources were sulfated (Kheifets et al., *Tr. Vses. Nauchn.-Issled. Inst po Pererabotke Nefti* No. *9,* 81). C_{10} to C_{24} Alpha olefins suitable for detergents were prepared by polymerization of ethylene or propylene (Antonsen, *U.S. 3,108,145*).

Higher alcohols obtained by direct hydrogenation of fatty acids are preferred to those from hydrogenation of butyl esters for sodium alkyl sulfate manufacture (Brunshtein and Klimenko, *Khim. Prom. 1961,* 253). Oxidation of hydrocarbons to alcohols by several routes gave high-molecular weight alcohols suitable for detergent usage (Varlamov et al., *Tr. Nauchn.-Issled. Inst. Sintetich Zhirozamenitelei i Moyuschchikh Sredstv 1960*(1), 21). The alcohol 1-hydroxymethyl-4-phospha-3,5,8-trioxabicyclo (2,2,2)octane-4-sulfide was reacted with ethylene oxide to give nonionic surfactants (Raetz, *Belg. 634,141*). Oxo-alcohols of C_{10-16} were reviewed as surfactant raw materials (Rudkovskii et al., *Khim. Prom. 1964,* 663).

Cresols were used for producing nonionic surfactants by alkylating with olefins (Tsvetkov et al., *Koks i Khim. 1963*(10), 40). Detergent raw materials and their processing were discussed (Stroebele, *Chem.-Ingr.-Tech. 36,* 858). Patented were new aspects of the technology and control of alkylphenol production (St. Anastasin et al., *Rev. Chim.* (Bucharest), *15,* 71).

Erucic acid was used in the preparation of many types of surfactants (St. Fulde, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963*(2), 33). Araliphatic acids synthesized by condensing benzene, methyl phenol, phenol, or naphthalene with omega-chlorocarboxylic acids obtained from alpha, alpha, alpha, omega-tetrachlorinated alkanes were substituted for oleic acid in the production of the basic types of surfactants (Smirnova et al., *Vestn. Tekhn. i Ekon. Inform. Nauch.-Issled. Inst. Tekhn.-Ekon. Issled Gos. Kom. Sov. Min. SSR po Khim. 1962*(6), 16). The constitution of sulfated dark and pale whale and herring oils as raw materials was studied (Burton and Byrne, *J. Soc. Leather Trade's Chemists 47,* 305). Sperm alcohol was sulfated to give a stable, fluid product (Yoritachi et al., *Japan. 1667* ('64). Sulfated products from Safflower or tobacco seed oils were prepared (Kasiviswanadham and Murti, *Indian Oil Soap J. 28,* 291). Sperm oil and dihydric alcohols were reacted and the product either sulfated or ethoxylated (Kato, *Japan. 26,460* ('63).

Soaps were prepared from waste oils of high acid number and soft industrial fatty acids (Szeplaky, *Novenyolaj-es Haztartasi Vegyipari Kutalointezet Kozlamenyei 1960,* 17). Anionic surfactants were produced from cardanol, tetrahydrocardanol and their derivatives (Sethi et al., *Indian J. Technol. 1,* 348). Tall oil fatty acids were used in producing a soft soap (Aktiebslag, *Soap, Perfumery, Cosmetics 37,* 411). A surfactant for textile usage was prepared by reacting sulfuric acid with benzene and refined tall oil (Bojanowska et al., *Pol. 47,631*).

New nonionic surfactants were claimed derived from epoxidized oils (Johnson, *JAOCS 41,* 191). Epoxidized high molecular-weight surfactants were obtained by sulfonation (Bohme Fettchemie G.m.b.H. *Brit. 949,249*). Midchain vicinal dihydroxy long chain compounds and ethylene oxide gave oxyethylated diols. Also prepared were oxyethylated long chain nitriles (Wrigley, *U.S. 3,119,848*).

SYNTHESIS OF AMPHOTERICS. A liquid amphoteric product resulted from the condensation of dicyanogen diamide and an amino carboxylic acid with formaldehyde in an acid or neutral medium (Selle, *Ger.(East) 25,331*). Polyampholytes were prepared by treating substituted vinyl pyridine copolymers with unsaturated dicarboxylic acid (Lebedev et al., *U.S.S.R. 164,291*). An ampholytic surfactant was obtained by reacting monochloroacetic acid with, for example, 1-(2-hydroxyethyl)-2-undecylimidazoline to give the betaine (Farbwerke Hoechst A.-G. *Belg. 626,569*).

SYNTHESIS OF ANIONICS. A hydrotrope comprising an ethoxylated alkylphenol or alkoxy primary phosphate is used with ethylene oxide nonionic surfactants (Dupre and Fordyce, *Belg. 632,444*). Ethylene oxide alkylphenol, alkanol, or tert-alkyl primary amine reaction products are treated with an excess of phosphoric acid (Mansfield, *Fr. 1,364,794*). Reaction of white phosphorus with air and an alcohol in an inert solvent gives esters of hypophosphorus acid (Wardi, *Belg. 631,015*). Higher alkyl phosphonates and phosphates are claimed containing two C_{1-3} alkyl groups and one C_{12} alkyl group (Laughlin, *U.S. 3,138,629*). A series of alpha-phosphono fatty acids and their salts were prepared (Maurer et al., *JAOCS 41,* 206). Hydroxymethylenephosphinic acids are claimed giving products of the formula $H(ROCH_2)P(O)(OH)$ (Uhing and Toy, *Fr. 1,346,938*).

Symmetrical secondary alcohol sulfates were prepared by the reduction of ketones and sulfonation with acetyl sulfate (Shimokai and Fukushima, *Yukagaku 12,* 516). Long chain alkyl hydrogen sulfates and their various amine and amine acid salts were prepared (Maurer et al., *U.S. 3,133,946*). Alkyl sulfates were produced from synthetic alcohols by sulfur trioxide sulfonation in an inert solvent (Kudryashov and Getmanskii, *U.S.S.R. 159,594*). Fatty alcohol sulfates were produced continuously by a novel process of sulfation with sulfuric acid at controlled flow rates by two steps, neutralizing continuously (Vyskocil and Lollok, *Czech. 108,690*). Alcohols of C_{8-20} atoms were sulfonated with diammonium imidodisulfate in dialkylamide (Miyamoto et al., *Ger. 1,159,429*). Fatty alcohols and dodecylbenzene sulfonate were sulfonated separately then combined (Bolyanovskii et al., *U.S.S.R. 160,256*).

Sulfates with excellent surfactant properties were derived from ether alcohols obtained by reacting an olefin with polyhydroxy compounds (Shell Internationale Research Maatschappij N.V. *Fr. 1,337,681*). Sulfated esters of alcohol ethers are obtained whose general formula is $R[(OCHR'CHR'')_mYO_xM]_n$ where R is an organic group with a reactive H atom, R' and R'' are hydrogen or methyl, m is 35 to 75, n is 1 to 4, Y is a dibasic carboxylic group with 8 carbon atoms or less, sulfur or phosphorus, x is zero if Y is the dibasic acid and 3 or 4 if sulfur or phosphorus, and M is the residue of a compound forming a salt (Unibasic, Inc., *Belg. 630,043*). Ethoxy sulfates are produced from alkylthio ethoxyethanol by sulfonation (Shell Internationale Research Maatscaappij N.V. *Belg. 625,001*).

Amino alkyl sulfates were produced by refluxing alkanolamines with sulfuric acid (Pizzarello et al., *U.S. 3,133,950*). Addition products of half esters of sulfuric acid with reaction products of tertiary amines, olefins and sulfur trioxide are surfactants (Henkel & Cie., G.m.b.H. *Belg. 630,991*). Amino carboxylic acid surfactants are neutralized by a mixture of alkanolamines and aminoalkane sulfonic acid as their alkaline salts (Farbwerke Hoechst A.-G. *Belg. 628,833*).

Diphenyl oxide is alkylated, halogenated, and sulfonated to give alkylchlorodiphenyl oxide sulfonic acids (Steinhauer and Valenta, *U.S. 3,110,683*). Claimed was 3-chloro-2-hydroxypropane-1-sulfonate (Cambre and Theile, *Belg. 629,026*). Haloethers were treated with an alkali metasulfite in water, water-alcohol, water-ketone or water-ether mixtures to give tertiary alkyl sulfoalkyl ethers (Shell Internationale Research Maatschappij N.V. *Belg. 632,843*). Alkali salts of β-alkylvinylsulfonates were claimed (Schenck and Shown, *U.S. 3,127,442*). Chlorinated alkyldiphenyl ether is sulfonated for surfactant usage (Valenta and Steinhauer, *U.S. 3,127,441*). The preparation of bis(hydroxyalkyl) sulfones and beta-hydroxyalkane sulfonic acids is disclosed (Farbwerke Hoechst A.-G. *Fr. 1,356,077*).

Described is a process for preparing a fatty acid ester of a hydroxyalkane sulfonic acid compound (Koczorowski et al., *U.S. 3,151,136*). The preparation of salts of α-sulfonated fatty acid esters is described as exemplified by the sodium salts of capryl-α-sulfopelargonate (Stirton et al., *U.S. 3,128,294*). Surfactant materials effective as emulsifiers were fatty acid esters of hydroxytriterpene carboxylic acids (Brieskorn and Wittner, *Congr. Sci. Farm., Conf. Comm.* 21°, Pisa *1961*, 228).

The effect of temperature upon the sulfation of condensation products of di- and triethanolamine with oleic acid was determined, the maximum degree of double bond sulfation being under optimum conditions of 40 to 60C and 100% excess sulfuric acid (Zajic and Kahnovcova', *Inst. Chem. Technol. Prague 6–1*, 265). The preparation of half-esters of sulfosuccinic acid are discussed and their properties noted (Hoffmann, *J. Soc. Cosmetic Chemists 14*(11), 591). Alpha-sulfoalkylcarboxylic acids were prepared by sulfur trioxide sulfonation in a chlorinated hydrocarbon (Schubert and Harkness, *Ger. 1,153,360*). Alpha-sulfofatty acids were prepared by sulfur trioxide sulfonation of the fatty acids in a straight chain hydrocarbon (Gavlin et al., *U.S. 3,104,247*). Alpha-sulfonated fatty acid esters were prepared conforming to the formula $RCH(SO_3M)COOR'$, where R is a n-alkyl group, R' is selected from a group consisting of dodecafluoroheptyl, and M is sodium, potassium or ammonium (Stirton et al., *U.S. 3,128,294*). Sodium alkenyl derivatives and their carboxylation products were prepared from a sodium alkyl with a non-terminal alkane, these converted to the carboxylic acids (Broaddus, *Fr. 1,352,735*).

Aliphatic disulfonates were prepared by reacting sodium bisulfite with long-chain olefins followed by air oxidation (Thomas and Strobele, *Ger. 1,154,093*). Alkyl sulfonic esters were prepared by the partial sulfochlorination of a mixture of aliphatic saturated hydrocarbons followed by reaction with a phenol (VEB Leuna-Werke "Walter Ulbricht," *Fr. 1,327,477*). Tertiary butyl alkane sulfonates were prepared by treating isobutylene with alkanesulfonic acids in liquid sulfur dioxide at −40 to −80C (Wolff and Johnson, *U.S. 3,136,802*). Gaseous vinyl chloride was reacted in a persulfate solution to form low polymer sulfates or sulfonates (Lefevre and Hahn, *U.S. 3,128,298*). Alkyl alkene-sulfonates were obtained by treating carbyl sulfate with an alcohol and a base (Farbwerke Hoechst A.-G. *Belg. 634,902*). High molecular weight hydrocarbons were saturated with sulfur dioxide then chlorosulfonated and saponified (Volkov and Vokova, *U.S.S.R. 161,860*). Sulfonyl chlorides obtained by oxidizing chlorination of the sulfur compounds in petroleum were saponified to give surfactants (Dronov et al., *Khim. Seraorgan. Soldin, Soderzhashch. v. Neft. i Nefteprod., Akad. Nauk SSSR, Bashkirsk. Filial 6*, 289). A neutral sulfonate from dewaxed Mid-continent solvent raffinate was converted to the calcium, highly basic salt (Gragson, *U.S. 3,152,991*).

New derivatives of taurine were reviewed (Ackermann, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963*(4), 39). N-(2-Hydroxyalkyl)-N-methyl taurines were prepared by heating an alkali salt of N-methyltaurine with an equimolar amount of 1,2-epoxyalkane (Cahn and Kaniecki, *Belg. 618,901*). Upon condensing fatty acids directly with sodium taurines a secondary undesirable, highly hygroscopic monosodium salt of N-methylditaurine is formed. Other approaches to prevent ditauride formation were outlined (Elbel, *Tenside 1*(1), 26). Homopolymers of alkali metal beta-alkylethane sulfonates were prepared by heating an alkali metal salt of a β-alkylisethionate at pH 6 to 9 and 120 to 250C (Schenck and Shown, *U.S. 3,130,184*). Maleic anhydride or maleic acid were reacted with $H(CF_2)_nCH_2OH$, where n is 1 to about 12 to give fluroalkylacid maleates (Zimmerman, *U.S. 3,128,303*). Polyfluoroalkyl iodides were treated with fuming sulfuric acid to give polyfluoroalkanoic acids (Hauptschein and Parris, *Fr. 1,343,601*).

Polyamine surface-active chelating agents of the N-(alkylbenzyl) diethylenetriamine acetic acid type were claimed (J. R. Geigy A.-G. *Brit. 950,384*). Surface active salts of 5-sulfophthalic acid esters and amides were claimed (Burkhardt, *Ger. 1,177,629*). Aryl ethers of gamma-hydroxybutyric acid were formed by adding aqueous alkali to mixtures of a phenol and gamma-butyrolactone (Toepel, *Ger. 1,155,139*). Alkylphenoxybenzoic acids were prepared by carbonation of the corresponding Grignard reagents (McCoy, *U.S. 3,113,849*).

Sodium 2-hydroxy-3-alkoxypropanesulfonates were synthesized from glycidyl ethers and sodium sulfite (Kuwamura, *Kogyo Kagaku Zasshi 66*(2), 215). Free lignosulfonic acids obtained from spent sulfite liquor were prepared by removing at least 30% of the pulping base ions present then concentrating and polymerizing by heat to give stable lignosulfonic acids (Wiley and Benko, *U.S. 3,148,177*). Surfactants were prepared by sulfonating a mixture of terpenes, resin abietic acids and phenol (Petrov, *U.S.S.R. 65,887*). Fatty acids sulfonated in the terminal position were described (Beduneau, *Rev. Prod. Chim. 65*(1293), 3). Described was a method for inhibiting crystallization in alkali metal soaps of disproportionated rosin and rosin-fatty acid mixtures (Lambert, *U.S. 3,135,698*).

A process for the synthesis of acylamidomethanesulfonic acid surfactants by a two-step procedure was described (Debska and Hopfinger, *Przemysl. Chem. 43*, 359). Beta-hydroxysulfonamides were prepared by a dioxane-sulfur trioxide sulfonation in ethylene chloride of 1-dodecane and aniline (Klass, *U.S. 3,116,325*). Free radical chlorination of long-chain amines in concentrated hydrochloric acid gave surfactant hydrochlorides (Komori et al., *Kogyo Kagaku Zasshi 67*, 327).

Oligosaccharides such as lactose or sucrose are reacted with propylene oxide and the products treated with a polybasic acid such as sulfuric or maleic (Hagge et al., *Fr. 1,342,613*). Polyglycol ethers of tertiary octylphenols are sulfated (Isagulyants and Gel'Zina, *Maslob. Zhir. Prom. 27*(6), 25).

ALKYLARYL PRODUCTS. Chlorinated C_{10-17} paraffin is used to alkylate benzene and the alkylate sulfonated to produce biodegradable surfactants (British Hydrocarbon Chemicals Ltd. *Belg. 623,465*). The same chlorinated paraffins but a higher paraffin feed containing 95% normal C_{4-5} paraffins was transformed to monochlorides (British Hydrocarbon Chemicals Ltd. *Belg. 623,466*). A C_{10-17} paraffinic feed of at least 95% normal paraffins is oxidized to secondary alkylborates, the olefins recovered and used to alkylate benzene (British Hydrocarbon Chemicals Ltd. *Belg. 623,467*). An alkylate suitable for biodegradable detergents is prepared by polymerizing 4-methyl pent-1-ene and condensing the C_{12-18} polymer with benzene (British Petroleum Co. Ltd. *Belg. 631,244*). 1-Hexene is synthesized, recovered, and dimerized, this condensed with benzene to yield a biodegradable alkylate (Hambling, *Belg. 635,393*). Monochloride straight chain C_{8-18} paraffin is reacted with an aryl compound to form a biodegradable product (Feighner and Kapur, *Brit. 969,104*). A normal tetramethylene or perhydrophenyl group links a benzene ring to a branched alkyl group for improved detergency and biodegradability (Cohen, *U.S. 3,115,530*). A mixture of over 96% dodecylbenzene and about 3% dodecylcumene contains over 72.3% 1-phenyldodecane with other isomers useful for biodegradable surfactants (Sharman, *U.S. 3,121,123*).

Reviewed were procedures for alkylation, and dialkylation of benzene and the sulfonation of such products (Faingol'd et al., *Sintetich. Moyushchie Veshchestva iz Slantsevoi Smoly. Akad. Nauk Est. SSR, Inst. Khim. 1964*, 136).

The synthesis of alkyldiphenylalkylbenzene sulfonates is disclosed (Perrus et al., *Fr. 1,345,126*). Claimed is the sodium salt of benzylnaphthalenesulfonic acid (Skudrzyk, *Pol. 47,700*). Butylnaphthalenesulfonates as wetting agent "NB" are claimed (Kafarov et al., *U.S.S.R. 159,833*). A process for preparing hydrotropic sulfonates is disclosed in which interfering sulfones, disulfonates or inorganic salts are removed from benzene or alkylbenzene sulfonates (Witco Chemical Co. Inc. *Fr. 1,349,806*). A process for hydrotropic alkylbenzene sulfonates such as xylene sulfonate is detailed (Giraudi and Sharphouse, *Brit. 963,787*).

SYNTHESIS OF CATIONIC SURFACTANTS. A cationic surfactant is claimed comprising the reaction product of a vegetable oil and epichlorohydrin which is further reacted with ethylenediamine (Ishihara, *Japan. 19,105*('63). Quaternary ammonium bases such as tetramethyl ammonium hydroxide are prepared by passing a solution of their chlorides in (water) through a strongly basic anion exchanger in the hydroxy form (Kreshkov et al., *U.S.S.R. 161,769*). Preparation of cationic surfactants based on alkylbenzenes are described, an example being p-alkylbenzyl chloride (Gershenovich and Stefanovich, *Khim. Prom. 1964*(6), 416). Decolorized quaternary ammonium compounds can be obtained by adding phosphoric acid to a tertiary amino compound during its alkylation (Weinstein et al., *U.S. 3,146,267*).

A number of diaminedioxides and their preparation are described (Zimmerer and Drew, *Belg. 626,346*). Tertiary amine oxides can be obtained by oxidation of the corresponding amine which is prepared by alkylation of a secondary amine (Drew, *Belg. 625,275*). A cationic surfactant was obtained by condensing 1-(2-hydroxyethyl)-2-undecyl-2-imidazoline with $ClCH_2CH(OH)CH_2SO_3Na$ (Jaccard, *Swiss 373,047*).

A number of hydrazinium salts were prepared as exemplified by the mixed olive oil fatty acid salts of methyldihydrotallow-hydrazinium cation (W. R. Grace & Co. *Brit. 933,465*). Surfactant sulfoxonium methosulfates were described, an example being dodecyldimethylsulfoxonium methosulfate (Berry, *Belg. 630,489*). Reaction of stoichiometric amounts of organic halide and N,N,N′,N′-tetrasubstituted thiourea gave a number of surface active thiuronium halides (Loev and Massengale, *U.S. 3,123,636*). Long chain tertiary monoamines are reacted with epichlorohydrin to give quaternary ammonium salts which are treated with sodium sulfite to give sulfobetaines containing an OH group (Henkel & Cie. G.m.b.H. *Belg. 634,546*). Polyallyl cationic surfactants are disclosed based upon polymerization of allylchloride, this then reacted with N-dodecylpiperidine and phenylnitrite (Narasaki, *Japan. 20,740('63)*. Fatty derivatives of aminoalkyl and hydroxyalkyl heterocyclic bases were prepared as exemplified by the reaction of piperidinopropylamine with tall oil fatty acids (Katz, *U.S. 3,114,649*). A surfactant for acidizing oil-bearing strata consists of an acid solution of an imidazoline derived from a detergent-forming acid and a polyethyleneamine and an acylated aminoethanol (Cooper, *U.S. 3,106,531*). Substituted stearic acid sugar esters were prepared to contain nitrogen substituents such as 12-amino and others (Ismail and Simonis, *Angew. Chem. 75*, 1102).

Surfactant polycarbonates were chloromethylated, purified, then reacted with dimethylaminoethanol to give aminated cationic surfactants (Sugi et al., *Japan. 16,796('63)*. Phenoxy, ethoxylated hydroxypropyl amines are quaternized (Neracher and Winicov, *U.S. 3,102,912*). Polyhexamethylenepolyamine-alkylene oxide products are treated with a mixture of carboxylic acids and a quaternizing agent (Boardman et al., *Fr. 1,349,060*).

SYNTHESIS OF NONIONIC SURFACTANTS. Alkyl mono- or dialkyl phenyl alcohols, $RO(CH_2CH_2O)_nH$, are reacted with a tertiary olefin in the presence of a poly(sulfonic acid) resin to produce nonionic surfactants (Rohm & Haas, *Belg. 628,056*). Described was the synthesis of polyglycol ethers of tert-octylphenol with ethylene oxide (Wu and Isagulyants, *Tr. Mosk. Inst Neftekhim. i Gaz. Prom. No. 44,* 110). Molecularly homogeneous p-tert-octylphenoxypolyethoxyethanols were prepared and separated by distillation and multichromatography (Mansfield and Locke, *JAOCS 41*, 267). Various alkanol and nonylphenol ethylene oxide condensates were prepared (Abe and Watanabe, *Kogyo Kagaku Zasshi 66, 1842*). Nonylphenyl-ethylene oxide-propylene oxide surfactants were claimed (Dupre and Boettner, *U.S. 3,118,000*).

Esters of an alcohol such as pentaerythritol and a carboxylic acid are transesterified under conditions to form polyhydric alcohol esters. Also used were sucrose with methyl esters of fatty acids (O'Boyle, *U.S. 3,141,012*). Cyclic esters of fatty carboxylic acids are reacted with xylitol and the product condensed with ethylene oxide (Ledoga S.p.A. *Brit. 966,026*). Esters of fatty acids with xylitol are claimed (Ledoga S.p.A. *Belg. 626,870*). Long chain monohydric alcohols are reacted with alkylene oxide followed by treatment with epichlorohydrin. Dehydrochlorination yields a polyether-substituted glycidyl ether (Gaertner, *U.S. 3,102,893*). Nonionic urethans were obtained by reacting pentaerythritol with normal-alkyl isocyanates (Ulsperger and Jacobi, *Fette, Seifen, Anstrichmittel 66,* 43). Alkylurea N-glucosides were obtained by treatment of glucose in dimethylformamide with monoalkyl urea (Okahara et al., *Kogyo Kagaku Zasshi 66*, 948). Sucroglycerides of mixed fatty acids were described (Tudisco and Turner, *Riv. Ital. Sostanze Grasse 40*, 528). Sucrose aliphatic saturated or unsaturated fatty acid esters were claimed (Thomas y Cia. S.L. *Span. 272,366*). Monoesters of sucrose were prepared by transesterification of fatty acid esters of low molecular weight alcohols (Ister, *Fr. 1,365,067*). Sucrose was treated with an alkali metal in liquid ammonia, the ammonia removed, followed by reaction with an organic halide (Evidenzbuero Oesterreichischer Zuckerfabriken G.m.b.H. *Austrian 231,472*). A urea addition compound with sucrose stearate was claimed (Tamate, *Japan. 18,671*('63). Polysaccharides are treated with alpha-halo or vinyl ethers to give a semiacetal structure (State of Israel et al., *Brit. 941,268*). The course of the esterification reaction between sucrose and fatty acid methyl esters was investigated (Zajic and Auerswald, *J. Inst. Chem. Tech. Prague 7-1*, 151; *7-2*, 205). Carbohydrate ethers are prepared by treating partially substituted derivatives of mono- or oligosaccharides with olefins or alkyl vinyl sulfones (Evidenzbuero Oesterreichischer Zuckerfabriken G.m.b.H. *Austrian 235,860*). Mono- and bis(alkoxymethyl)ethers of sucrose are claimed (Ames et al., *J. Appl. Chem.* (London), *14, 245*). A glyceride is treated with xylitol in the presence of a salt of an alkali metal to give esters which may be used as such or reacted with ethylene oxide (Ledoga S.p.A. *Brit. 952,334*).

Alkanolamines may be reacted with low molecular weight alkylene oxides and styrene oxide (Bindler and Keller, *Ger. 1,168,077*). High molecular weight alkylamines are ethoxylated (Boehme Fettchemie G.m.b.H. *Fr. 1,341,843*). The preparation of phenoxy, ethoxylated hydroxypropylamines is described (Neracher and Winicov, *U.S. 3,102,912*). A process for the manufacture of alkanol fatty acid amides is described (Hoppe and Deiters, *Ger. 1,160,449*). Ammelide was heated with cocoanut fatty acid amide to give a surfactant (Dambacher and Hoerig, *Ger. 1,174,322*). Nonfoaming surfactants comprising ethers of n-(hydroxymethyl lactams are synthesized (General Aniline & Film Corp. *Brit. 947,910*). The preparation of alkylene oxide-N-alkylacrylamide addition products is claimed (Sexsmith and Sheers, *Belg. 626,684*).

Vinylsulfonamide salts derived from long chain olefins are prepared (Klass, *U.S. 3,116,257*). Tertiary carbinamines are treated with ethylene and propylene oxides to give surfactants (Boettner and Dupre, *U.S. 3,117,999*). A $C_{11}H_{23}CO\overset{-}{N}\overset{+}{N}Me_3$ product was prepared and demonstrated as nonionic in character (Berry and Brocklehurst, *J. Chem. Soc.* 2264 *(1964)*). Amidated proteinaceous materials are treated with fatty acid esters to give surfactants (Young and Spitzmueller, *U.S. 3,138,581*).

The oxirane ring of hydrophobic aliphatic or alicyclic epoxy compounds is opened and these reacted with oxalkylenes (Johnson, *Fr. 1,349,807*). Formaldehyde resins with nonylphenol were polyoxyethylated to give polymeric surfactants (Hayano et al., *Yukagaku 12, 625*). Natural or synthetic carboxylic acids are condensed with polyethylene glycols and formaldehyde (Ranny and Prachar, *Czech. 97,568*). A polymeric anhydride (preferably a 1:1 interpolymer such as styrene and maleic anhydride) is reacted with a hydroxyl containing surfactant such as an alkylene oxide condensate with a fatty acid (Woodward and Grifo, *Belg. 629,136*). Terminally unsaturated olefins are converted to 1,2 glycols and these converted to polyglycol ethers (Henkel & Cie. G.m.b.H. *Belg. 635,444*). Surfactant polycondensation products are prepared from alkylene glycols by treatment with a phosphorus acid or chloride and the distillation products removed (Bohunek, *Ger. 1,156,563*). The product distribution in the hydoxyethylation of butanol and related compounds with ethylene oxide was studied. The product distribution followed the Weibull law but was affected by the catalyst nature and acidity of the reacting compound (Hsu, *Hua Hsueh Hsueh Pao 29*, 426). A review of the synthesis and properties of polyethers contained 142 references (Ishii and Okada, *Yukagaku 12*, 490).

COMPOSITIONS

ADJUVANTS. Alkali trimetaphosphate is converted into tripolyphosphate and hydrated by adding strong alkali and heating, in the presence of ABS and other usual additives. During the conversion a foam is created and on drying a nonhygroscopic, free flowing detergent composition is produced (Feierstein et al., *Belg. 633,146*). Poly(vinyl pyrrolidinone) was compared with carboxymethyl-cellulose as an antiredeposition agent and found more effective for liquid detergents (Eichelmannova, *Prumsyl. Potravin 14, 660*). A composition which minimized redeposition consists of an organic anionic surfactant and a water soluble condensate of formaldehyde with either urea or melamine (Touey and Davis, *U.S. 3,152,993*). The vapor pressures of detergent solvents are reduced by condensation of the C_{4-6} aliphatic alcohols with ethylene oxide (Maubec, *Fr. 1,338,886*).

Extensive bibliographic abstracts of detergent brightening agents were presented (Weeks et al., *Am. Soc. For Testing & Materials, Spec. Tech. Publ.* No. 177-A). Brightening of bleached gray cotton knit goods was obtained by using a brightening agent, nonionic detergent, hydrogen peroxide, and borax (Rogers, *U.S. 3,142,531*). A spectrographic method is used to measure the bleaching effect of brightening agents (Bocharov, *Vestn. Mosk. Univ., Ser. III, Fiz., Astron. 19*(4), 52).

A phosphorus-based deflocculent and sequestrant is described, combining the advantages of polyphosphates and organic chelating agents (Irani and Callis, *Mfg. Chemist 36*, 43; *Soap Chem. Specialties 40*(4), 64). Solubilizers for detergents such as alkylarenesulfonates and inorganic builder salt are tetrasodium EDTA, iminodiacetic acid, nitriloacetic acid and others (Schlitz and Rogers, *U.S. 3,151,084*). The manufacture of hydrotropic solubilizers, salts of p-toluenesulfonic acid and xylenesulfonic acids is described (Phillips, *Mfg. Chemist 34, 575*). Certain tertiary arsine oxides in detergent compositions act as solubilizers of alkaline earth soaps, and are claimed to have other useful properties (Laughlin, *U.S. 3,147,295*). Lumping of granular detergent compositions is inhibited by urea addition (Schwalley, *U.S. 3,130,166*).

ANTISEPTIC. The bacteriological action of cationic surfactants in the disinfection often depends on chemical constitution and the type of microorganism (Aru, *Nuovi Ann. Igiene Microbiol. 15,* 1). The action of anionic surfactants on various growth stages of fungi were described, the conclusion being that they were generally ineffective in combatting pathogenic fungi (Darnell, *Lipidos 23,* 1). Developments in dairy sanitizers were discussed and a quaternary-polyphosphate-chelating agent studied, showing that its use reduced the total bacteria numbers and thermoduric bacteria in raw milk (Speck. *N. Y. State Assoc. Milk Sanitarians, Ann. Rept. 33,* 95). A dairy cleaning and sterilizing composition contained a nonionic low sudsing surfactant, a sequestrant and a quaternary surfactant (Wotzilka, *Brit. 964,448*). A sanitizing detergent composition for diapers comprised a surfactant, tripolyphosphate, sodium carbonate, and chloroisocyanate (Crowther, *Brit. 952,058*).

An iodophor was claimed to be nonirritant and effective in skin sterilization (Cotlar and Cohn, Jr., *Arch. Surg. 87,* 857). The stability, staining, and corrosive properties of an iodine-nonionic surfactant product was investigated (Hugo and Newton, *J. Pharm. Pharmacol. 16, 273*). A new class of iodine containing compositions comprises complexes of iodine with a new class of surfactants—salts of quaternary ammonium derivatives of gamma-(alkylated phenoxy)-beta-(ethoxylated hydroxy)-di-N-substituted propylamines (Winicov, *U.S. 3,102,839*). Reduced viscosity iodinated detergents were prepared by substituting hydroxyacetic for a part of the phosphoric acid normally used (Cantor et al., *Belg. 630,334*). Iodine complexes were obtained by polymerizing N-vinyl-nitrogen compounds (Grosser and Susko, *U.S. 3,136,755*). Polymers of heterocyclic N-vinyl compounds such as poly(N-vinyl-2-pyrrolidinone) are complexed with iodine to give germicidal products (General Aniline & Film Corp. *Fr. 1,354,115*).

A bactericidal fatty acid soap contained a fatty acid amide in addition to hexachlorophene or trichlorocarbanilide (Oy, *Belg. 626,628*). Antiseptic detergents were obtained by adding halogenated carbanilates to soap (Beaver and Stoffel, *U.S. 3,142,646*). Color stabilizers such as organic S-N compounds are added to soap containing phenolic bacteriostatic 2.2′-thiobis(4,6-dichlorophenol) (Mitoray and Bauer, *U.S. 3,145,179*). Claimed was the addition of any common arylamide of a hydroxybenzoic acid to a dry cleaning fluid to prevent transfer of bacteria from one article to another, also killing those present (Langheinrich et al., *Ger. 1,162,965; Belg. 634,125*). A cleaner-germicide-deodorizer comprises a polypropyleneglycolethylene oxide condensate, an amphoteric surfactant, a chlorinated bisphenol or bithionol, alkylarenesulfonate, and an alkaline buffer (Besser, *U.S. 3,118,842*). Di- and tribromosalicylanilides were described for use in detergents (Molner and Baron, *JAOCS 41,* 478). A germicidal skin detergent contains 1-hydroxy-2-pyridinethione, its salt or 2,2′-dithiopyridine 1,1′-dioxide (Karsten and Taylor, *Brit. 957,458*). Soap or syndet compositions are rendered germicidal by adding the N-oxides of 2-mercaptopyridines or certain of their salts. (Schramm, *Brit. 970,955*).

BAR AND TABLET COMPOSITIONS. A soap bar used for oily skin contains 1 to 1.75% grit-free, water-insoluble sodium metaphosphate (Schulerud, *U.S. 3,105,051*). 10 to 30% of an alkaline earth salt of a mixture of sulfonated monophenyl-substituted alkanes, whose structure corresponds to a mixture of acrylic polypropylenes, is added to sodium or potassium soap to form a hard-water bar (Kelly, *U.S. 3,150,097*). Soap or soap-surfactant mixtures are used to produce superfatted compositions, the fatting agent being petrolatum (Farrar and Schulerud, *Ger. 1,165,191*). A synthetic toilet bar is comprised of sodium alkylbenzenesulfonate, stearyl alcohol, n-paraffin wax, monoethanolamide of aliphatic carboxylic acid, and water (Meehan, *U.S. 3,129,187*). Mixtures of the sodium salt of stearyl or lauryl isethionates and sodium ABS are the detergent ingredients of a bar product (Wittwer, *Fr. 1,351,411*). Gases are blown into soap or soap-detergent mixtures to give an aerated product which can be extruded (G. Mazzoni S.p.A. *Ital. 637,961*).

The evaluation and formulation of detergent tablets is described (Jungermann et al., *JAOCS 40,* 699). A tablet comprising ABS, alkyl sulfate, fatty acid soap, tripolyphosphate, fatty acid ethanolamide, soluble silicate, perborate, soil suspending agent, and water, is described and details for preparation given (Jones and Picciotto, *Fr. 1,348,321*). A cake detergent is described comprising a non-cationic surfactant, a water soluble polyphosphate, and a water soluble silicate and details for preparation are given (Schaafsma et al., *Belg. 635,589*). Plasticized detergent tablets contain milk powder, potassium and magnesium alkyl sulfates, cetostearyl alcohol and water (Societe Belge de l'Azote et des Produits Chimique du Marly, S.A., *Belg. 627,260*). Tableted detergents releasing carbon dioxide upon contact with water contain ABS, sodium sulfate, sodium chloride, alkali carbonate or bicarbonate, a minimum of a polybasic acid with at least one hydrogen atom, a mono- or polyphosphate, and starch or cellulose. Details of tableting are given (Stepanek, Jr. *Ger. 1,158,197*).

BLEACHING COMPOSITIONS. A liquid bleaching and detergent composition contains an anionic sulfonate derived from an alkylaryl ethylene oxide adduct, polyphosphate, carboxymethylcellulose, and hydrogen peroxide (Best, *U.S. 3,130,164*). Liquid washing and bleaching compositions are cited comprising, as examples, disodium dihydrogen pyrophosphate, potassium toluenesulfonate, ethoxylated nonylphenol and hydrogen peroxide (Lindner and Eichler, *U.S. 3,131,991*).

Detergents containing sodium perborate are improved by adding an active ester such as sodium p-acetoxybenzenesulfonate and an active amide such as N,N′-diacetyl-p-toluidine (Unilever N.V. *Belg. 629,157*). Detergents containing perborates are improved by the addition of surface active sulfobetaines (Guendel et al., *Ger. 1,162,966*). Sodium perborate with a bulk density less than 0.7 was prepared by treating with hydrogen peroxide a solution of perborate containing magnesium sulfate and a small amount of fatty acid (May, *Brit. 944,121*). Sodium perborate in crystal form is obtained by reacting sodium metaborate with hydrogen peroxide (Yanush, *U.S.S.R. 156,940*). Perborate is activated by using copper ion and a sequestrant such as EDTA (Hertz and Noiriel, *Fr. 1,338,856*). Sodium percarbonate is stabilized in detergent compositions by adding magnesium salts (Pateryaiko and Labycheva, *U.S.S.R. 157,453*). A detergent composition comprises a surfactant which may be soap, anionics, nonionics, zwitterionics, or amphoterics, an inorganic peroxy compound, and an activator such as a peroxy compound of an ester of a phenol, containing at least one substituent carboxy or sulfonic acid group and an acid, such as acetic or propionic (Brocklehurst, *U.S. 3,130,165*). A detergent is claimed comprising sodium metasilicate, percarbonate or perborate, and these particles covered with a gum or carboxymethylcellulose (Szczepanik et al., *Pol. 46,747*). Alkylarylsulfonates are combined with esters of carbonic or polycarbonic acids, acting as releasing agents for per salts (Unilever N.S. *Belg. 631,982*).

Claimed is trisodium chlorophosphate, the active constituent being $Na_3PO_4.11H_2O.NaOCl$ (Sociedad Anon. Cros. *Span. 269,887*). An improved cleaner was claimed comprising a mixture of hydrated salts of trisodium phosphate, sodium hypochlorite, and a nonionic detergent (Karabinos and Ballun, *U.S. 3,110,677*).

A detergent bleaching composition is claimed containing solid particulate dichlorocyanuric acid stabilized with an olefin having a double bond and a tertiary carbon atom, a water soluble anionic surfactant stable to the bleaching agent, and builders (Wixon, *U.S. 3,108,079*). An oxidizing scouring cleanser is claimed containing dichlorocyanuric acid stabilized for example with butyl-4-nonene and ABS (Wixon, *U.S. 3,108,077*). Dry bleach compositions were prepared by a fluidized bed coating of polychlorocyanurates with inorganic salts such as sodium sulfate or tripolyphosphate (Morganthaler and Parks, *U.S. 3,112,274; Brit. 953,655*). A water soluble effervescent bleaching tablet is prepared from dichlorocyanuric acid, sodium sulfate, and an alkali metal carbonate (Lee and Sancier, *U.S. 3,120,378*). A stable fungicidal and bleaching complex is claimed by treating lead dichlorocyanurate with a cupric salt (Marek, *U.S. 3,115,493*). A method for preparing potassium dichlorocyanurate is detailed (Monsanto Chemical Co. *Brit. 937,615*). Storage stability of dichloroisocyanuric acid is improved for detergent compositions by mixing the wet isocyanurate with sodium tripolyphosphate until a free-flowing composition is obtained (Symes, *U.S. 3,108,969*). Discussed were the available forms of chloroisocyanuric acid and their formulations (Thompson, *Soap Chem. Specialties 40*(6), 45). Solid trichlorocyanuric acid is stabilized against decomposition by adding an organic compound having a double bond with one of the carbon atoms being tertiary, such as terpenes or 5-butyl-4-nonene (Wixon, *U.S. 3,108,078*). The water wettability of dichlorodimethyl hydantoin, trichlorocyanuric acid or halomelamines is improved by using various anionic surfactants (Glasgow, *U.S. 3,142,647*).

Heavy Duty Compositions. An alkaline, heavy duty detergent is comprised of an alkali metal polyphosphate and the reaction product of a mixture of primary and secondary phosphate esters of phosphorus pentoxide with a nonionic surfactant whose molecular configuration is defined (Grifo et al., *U.S. 3,122,508*). Heat dried detergents are prepared by substantially hydrating sodium tripolyphosphate in an aqueous system containing a small amount of surfactant, then adding surfactant to the resultant slurry prior to drying (Feierstein et al., *U.S. 3,133,024*). A solid composition consists of an alkylphenol ethylene oxide adduct, a water soluble ABS, carboxymethylcellulose, and polyvinyl alcohol (Inamorato, *U.S. 3,144,142*). A liquid heavy duty detergent comprised a quaternary surfactant such as 1-(cocodimethylammonium) propane-3-sulfonate, ABS, potassium toluene sulfonate, ethanol, sodium silicate, and water (Smith, *Ger. 1,170,574*). An improved detergent contains a mixture of oxyethylated sugar glyceride, ortho-, poly-, or pyrophosphates, sodium silicate, urea, an oxidizer and an optical brightener (Ledoga S.p.A. *Belg. 633,543*).

Liquid Compositions. A light duty liquid detergent consists of an ABS, an alkylphenoxypolyoxyethylene sulfate, the cationic components being selected from sodium, potassium, or ammonium (Wilson, *U.S. 3,150,098*). A liquid composition is claimed containing an alkali metal alkylarylsulfonate, toluene or xylene sulfonate, and alkylphenol polyoxyethylene ethers having a low to high ratio of ethylene oxide (Noad, *U. S. 3,140,261*). Liquid detergents of ABS mixed with alkylphenol polyoxyethylene products were especially effective when urea was used as the hydrotrope (Dworzeki and Thom, *Tluszcze i Srodki Piorce 7*, 135). A stable liquid is comprised of a nonionic emulsified acrylic monomer, polymer, or terpolymer of high molecular weight, anionic or nonionic surfactants and sodium polyphosphates or silicates (Fordyce et al., *Belg. 626,321*). A liquid composition is said to contain a nonionic ethylene oxide condensate, potassium pyrophosphate, a salt of an interpolymer of vinyl methyl ether and maleic anhydride, an alkali metal caprylate, and sodium or potassium silicate and sodium xylenesulfonate (Rosnati, *Belg. 624,160*). Tallow-based surfactants such as disodium 2-sulfoethyl alpha-sulfo stearate are used with foam stabilizers, isopropanol, potassium pyrophosphate, water and carboxymethylcellulose (Bistline and Stirton, *JAOCS 41*, 654). Heavy duty liquid products are prevented from phase separation by using a mixture of a water soluble cellulose derivative with a water soluble vinyl polymer in compositions containing ABS, sodium xylene sulfonate, potassium pyrophosphate and coco propanolamide (Wixon, *Ger. 1,156,927*). The solution or emulsification properties of a mixture containing ABS and other detergent components to which 10% xylene is added is increased equivalent to a 10-degree temperature increase (Davies, *Proc. Congr. Intern. Federation Soc. Cosmet. Chemists*, 2nd, London *1962*, 201).

Metal Cleaning and Corrosion. Medium alkalinity, pH12, cleaners are improved in removing greases of calcium soaps by adding sodium EDTA salts and by using high-boiling high-flash point glycols which synergistically produce stable single phase detergent solutions (Mankowich, *U.S. Dept. Com., Office Tech. Serv., AD 404,573*). Surfactants such as secondary alkyl sulfates were useful when used in trisodium phosphate-sodium metasilicate solutions for cleaning and preventing corrosion to cast iron and aluminum (Kachanov et al., *Maslob.-Zhir. Prom. 29*(8), 24). Federal Specification P-C-436a was revised to use anhydrous trisodium phosphate, metasilicate, and sodium dihydrogen phosphate and including an aluminum-magnesium couple corrosion test (Mankowich, *U.S. Dept. Com., Office Tech. Serv., AD 264,903*). A detergent solution of caustic soda was corrosion inhibited by adding a mixture of heptonic acids resulting from the cyanide carboxylation of invert sugar (Karabinos and Quinn, *U.S. 3,105,822*). A sequestering agent such as gluconic acid or its salt or gluconolactone is added to a water soluble peroxymonosulfate to inhibit discoloration of lead-bearing enamelled surfaces (Chadwick and Higbee, *Belg. 633,959*). Copper alloys reduced peroxide consumption but the effect of detergents was variable (Mosle et al., *Werkstoffe Korrosion 15*, 150). Stable alkali-soluble surfactants for metals are prepared from phosphorylated alkoxy or alkylphenoxy oxyethylated nonionics (Dupre and Mansfield, *Belg. 632,443*).

Aminophenols and toluidine are corrosion inhibitors for aluminum when used in alkaline solutions, attributable to sorption of the amino radical (Horiguchi et al., *J. Electrochem. Soc. Japan, Overseas Ed. 30*, 6). Nonirritating solutions useful for brightening aluminum comprise ammonium or ammonium acid fluoride and glycolic acid solution (Brite, *Brit. 945,024*). A carborundum abrasive potash linseed oil soap was used for cleaning aluminum (Pietruszynska and Pietruszynska, *Pol. 47,698*). A rust remover contains EDTA, humus acids, or chelating agents of molecular weight greater than 470, pH of 6.9 to 11.0, ions of ammonium, alkali metals, alkanolamines, and also contains various acids (Brehmer, *Finn. 32,438*). A spray process is used for cleaning metal surfaces, the detergent containing alkali borates and phosphates, with a nonylphenol ethoxylated surfactant (Freeman, *Ger. 1,170,220*). A self-emulsifying metal cleaning composition is disclosed, a typical formulation containing cyclohexanol, ethylene glycol monobutyl ether, diethylene triamine-acetone condensate, diethylene glycol oleate, ethanolamine oleate, sorbitan monooleate and amine neutralized alkylarylsulfonic acid, all in a coal tar naphtha and kerosine solvent (Rosenfeld and Wagner, *U.S. 3,146,207*). Aqueous solutions of basic barium dinonylnaphthalenesulfonate solubilized in isopropyl alcohol and combined with an aliphatic ketone provide low cost, water displacing, nonflammable slushing compositions (Baker and Singleterry, *U.S. 3,138,558*).

Shampoo and Skin Formulations. Differences occurring between shampoos sold for professional purposes and consumer market were discussed. Anionic type shampoos dominate the cosmetic market. Properties for a successful shampoo are listed (Shansky, *Am. Perfumer Cosmet. 79*(9), 31). Amphoteric surfactants for shampoos are cited, the preferred product being the sodium salt of N-(diethylaminopropyl)-N^2-dodecylasparagine (Kalopissis and Viout, *Fr. 1,344,212*). A sarcosinate based shampoo contains as essential ingredients N-acyl sarcosinate, an alkyl sulfate or an alkylethoxyalkylated ether sulfate, and a blend of acylmono- and diethanolamides (Anderson, *U.S. 3,085,067*).

A shampoo is cited containing an isopropanolamide-neutralized fatty alcohol sulfate and a mixture of monolauryldiethanolamine and palmitylamine adduct with three alkylene oxide groups (Weiss, *Ger. 1,172,791*). A shampoo is claimed comprising an amphoteric fatty amide of a degraded protein with half the amino acids in the free state and a quaternary ammonium compound (Barres, *Fr. 1,359,342*). A shampoo is claimed comprising solutions of nonionic and cationic surfactants with sufficient citric acid added to give a pH of 4.0 to 4.5 (Ciba Ltd. *Belg. 624,000*).

Processes and materials used in preparing waterless hand cleaners were discussed (Cruse and Miller, *Soap Chem. Specialties 39*(11), 41). A cleaning paste for skin and other usage contains silicic acid gel, carboxymethylcellulose, petrolatum oil, citric acid, and alkylarenesulfonate (Cefelin, *Czech. 107,396*). Liquid hair and skin cleaners contain triethanolamine salts of coco fatty alcohol sulfate, and the succinic acid salt of stearamide (Weiss, *Ger. 1,158,198*).

Textile Compositions. Granular products useful for simultaneous cleaning and dyeing of textiles contain a dye mixture with affinity to various fibers, a dyeing catalist, an optical brightener, and as a nonionic surfactant, the polyethylene glycol esters of fatty or resin acids (Radley et al., *Ger. 1,164,371.*) Polyoxyethylene derivatives of alkylphenols are added to the mineral oil lubricant used in textile machinery to improve oil spot removal (Zeidler, *Abhandl, Deut. Akad. Wiss, Berlin, Dl. Chem., Geol. Biol. 1963*(2) 92). The quality of optical brighteners is increased using a formulation comprising an alkali metal polyphosphate, and a phosphate ester of a nonionic surfactant (Grifco et al., *U.S. 3,122,508*). A textile floor covering cleaner consists of a humid mass containing an organic solvent, a surfactant such as a fatty acid-methyl taurine condensate, fatty alcohol sulfate or ABS, a carrier such as talc or wood flour, and ethylene glycol fatty acid esters (Ujma, *Pol. 47,264*). Greasy stains are removed from fabrics by a detergent composed of a polyethylene glycol ether, sodium EDTA, ethanol, glycerol and water (Witkowski et al., *Pol. 46,464*). Mineral oil or grease stains are removed from crude woven fabrics by a composition containing a polyethylene glycol ether, alkylarenesulfonates, dialkylarenesulfonates, sodium

EDTA, ethanol and water (Witkowski et al., *Pol. 46,828*). A cleaning and mothproofing detergent is comprised of bis(4-hydroxyphenyl)-methane as a disinfectant, tetrachlorodihydroxysulfotriphenylmethane as a moth proofing agent, sulfonated fatty alcohol, carboxymethylcellulose, soap, sodium silicate, optical brightener, perfumes, and water (Zajdler and Syrowatha, *Pol. 48,051*). Fabrics and rugs are cleaned with a composition containing a fatty-alkyl-dimethylamine acetate, and an optical brightener (Wood and Pacifico, *U.S. 3,134,738*). A composition for textile cleaning contains cresol, butylsulfooleate and potassium oleate (Milovanov, *U.S.S.R. 156,933*). Oil stains are removed from clothing and leather by a composition consisting of anionic surfactant, organic solvents, and water (Dryzazga and Skotnicki, *Pol. 46,646*). A liquid cationic textile softener is obtained by using a glycol or polyglycol to disperse a cationic surfactant characterized as $[RR'N(C_nH_{2n}NHR'')]^+X^-$, where n is 2 to 4, R is a $C_{1\ to\ 4}$ alkyl group, R' is a $C_{1\ to\ 8}$ alkyl or aralkyl, R'' is an aryl radical of a liquid $C_{12\ to\ 24}$ fatty acid, and X^- is an anion (Atlas Chemical Industries, Inc. *Brit. 953,496*). Fabric softeners are comprised of a quaternary ammonium or imidazolinium compound and a finely divided absorbefacient such as bentonite to give a free flowing powder (Blomfield, *U.S. 3,095,373*).

Miscellaneous Compositions. Stone is cleaned with a balanced acid sulfate-fluoride solution containing a slight excess of free hydrofluoric acid (Kovachy, *U.S. 3,150,007*). Plastics are cleaned and polished with a composition containing polyethylene melted with oleic acid, an MR wax, in an alkaline surfactant solution (Bednarska et al., *Pol. 47,919*). A paste cleaning agent to remove paint, nail lacquer or the like is comprised of an organic solvent, polyoxyethylene sorbitan monolaureate and colloidal silica (Furendal, *Swed. 184,496*). A detergent formulation is claimed consisting of a surfactant diamine oxide, an alkali metal salt of polyphosphoric acid, sodium sulfate and sodium silicate (Zimmerer, *Belg. 626,505*). A syndet is prepared by reacting stearic acid with sodium hydroxide and 2-amino-2-methyl-1-propanol, tripolyphosphoric acid, sodium metasilicate, and modified soda (Aoki, *Japan 23,770('63)*. A nondusting soap powder manufactured by airblowing is described, comprising soda soap, sodium carbonate, sodium metasilicate, and carboxymethylcellulose (Faellesforeningen for Danmarks Brugsforeninger, *Dan. 95,845*). Powdered detergents containing sulfonated hydrogenated fatty acid esters with various amounts of sulfonated fatty acids may contain tetrasodium pyrophosphate, liquid sodium silicate, sodium sulfate, and fatty acidethanolamide, which are intimately mixed and spray dried (Henkel & Cie. G.m.b.H. *Ger. 1,176,307*). Organic surfactants such as sodium lauryl sulfate are mixed with water soluble organosiloxane-oxyalkylene block copolymers to give nonhydrolyzable water soluble solutions (Bailey et al., *Fr. 1,353,669*). An improved drycleaning composition is obtained by adding N,N,N',N'—tetrakis(2-hydroxypropyl) ethylenediamine esterified by oleic acid and quaternized with methyl sulfate (Lawrence and Dowling, *Belg. 634,371*). Improved drycleaning solutions are obtained by adding to a hydrocarbon or chlorinated hydrocarbon a mixture of alkylarenesulfonic acid or its salt and a condensation product of an alkylene oxide with a phenol, alcohol, or mercaptan, and adding an alcohol, glycol, or ketone (Shell Internationale Research Maatschappij N.V. *Belg. 625,361*). A nondusting scouring agent comprises powdered tetrasodium pyrophosphate, kaolin, ultramarine blue, alkylarenesulfonate and water glass (v.Stoesser, *Ger. 1,168,589*). Industrial dust containing metal particles may cause corrosion through protective lacquer finishes. A cleaning composition which inhibits such corrosion consists of phosphoric acid, oxalic acid and a small amount of a neutral surfactant (Backhaus, *Ger. 1,161,374*). Glass, porcelain or enamelled surfaces soiled with fats or rust stains can be cleaned with compositions containing p-methyl-benzenesulfonic asid absorbed on kaolin and containing hydrochloric acid, perfume and dye (Kondicek and Kruzik, *Czech. 103, 840*). A dishwashing detergent contains the reaction product of lauric acid with (beta-aminoethyl)ethanolamine followed by treatment with chloroacetic acid, a nonylphenol glycol ether, an isooctyl phenol propylene oxide-ethylene oxide product, and sodium and potassium stearate. This product can be mixed with sodium ortho- and metasilicate, potassium tripolyphosphate, an alkali metal alkylarenesulfonate and water (Silbermann, *Ger. 1,161,375*). A nondusting free flowing soap powder and its manufacture is disclosed (Faellesforeningen for Danmarks Brugsforeninger *Dan. 99,845*). A wetting agent is comprised of the mono-, di-, and trialkanolamine salts of alkylarenesulfonates and alkylphenol or fatty alcohol ethylene oxide condensates (Blasinski and Jakobson, *Pol. 46,466*).

ANALYSIS

Analysis of Anionics. A new method for fatty acid determination in soap consisted of passing a methanol solution through an anion-exchange column, removal of acids and titration with tetramethylammonium hydroxide electrometrically (Kreshkov et al., *Maslob.-Zhir.Prom. 30*(3), 26). A rapid soap determination involved the use of the Van Gulick butyrometer (Batyai, *Elemiszervizsgalati Kozlemen 9*, 99). Fatty acids in toilet soap were determined by treating the soap with magnesium nitrate and filtering, the filtrate titrated with disodium dihydrogen ethylenediamine tetraacetate to give the percent fatty acids and another aliquot of the filtrate titrated with bichromate and silver nitrate for sodium chloride content (Montenegro and Prieto, *Grasas Aceites* (Seville, Spain) *15*, 69). A turbidity method for determining naphthenate soap, an ammonium molybdate method for silicate, and carbon dioxide evolution for carbonate are described (Aleksandrovich-Mel'nikova, *Tr. Astrakhansk. Tekhn. Inst. Rybn. Prom i Khoz.* No. *8*, 113). The importance of iodine values in fats and for soap manufacture is reviewed (BlasiGerones, *Lipidos 23*, 23).

A report was given of collaboratove studies of the comparison of the methylene blue and the p-toluidine method for determining anionic sulfates (Anon., *J. Soc. Cosmetic Chemists 15*, 33). The Longwell-Maniece method for determining detergents in the surface-, ground-, and waste-waters was simplified by omitting the multistage extraction procedure (Michelsen and Maerki, *Mitt. Gebiete Lebensm. Hyg. 52*, 557). A methylene blue colorimetric method for field determination is described (Cohen, *Sanitarian* (Los Angeles) *23, 194*). A quantitative colorimetric method for measuring anionics in waste water from wool washing depends upon lasting chloroform-soluble color complexes formed with methylene blue, fuchsin, and methylene green (Heidler and Motlova, *Textil. 18*, 16). Anionic surfactant is estimated photocolorimetrically using the colored methylene blue complex not interfered with by common ions present in detergent mixtures (Verigo and Mamontova, *Tr. Vses. Nauchn.-Issled. Inst. po Perarbotke i Ispal'z. Topliva* No. *12*, 213). The true molecular weight of a sulfonate surfactant can be determined by osmometry if initially converted to its methyl ester, permitting also characterization in terms of disulfonate and sulfone content (Metzger, *JAOCS 41*, 495).

Gas chromatography is used in analyzing alpha-olefin mixtures and straight chain alkylbenzenes (Kaelble, *Soap Chem. Specialties 39*(10), 56). The details of a gas chromatography procedure are given for measuring the composition of straight chain alkylbenzenes (Carnes, *Anal. Chem. 36*, 1197). Various raw materials were analyzed by gas-liquid chromatography, giving quick and accurate information about the composition, degree of purity, intermediates and some end products (Vasilescu, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963*(2), 13).

Cationic surfactant in trichloroethane and bromophenol blue indicator is used to volumetrically determine an anionic, pure tetrapropylenebenzenesulfonic acid being used for standardization (Praeger and Ramos, *Olaj Szappan Kozmet. 13*(1), 21). An alkyl sulfate in chloroform and methylene blue is titrated with a cationic surfactant, but more precise measurements are made using bromocresol green indicator (Getmanskii, *Tr. Nauchn.-Issled. Inst. Sintetich. Zhirozameniteli i Moyushchikh Sredstv 1960*(1), 77). The Barr bromophenol blue titration was preferred to the Epton methylene blue procedure because the endpoint was clearer. Attempts were made at analyzing mixtures of alkylarenesulfonates, alkyl sulfates, and polyglycolether sulfates by acid hydrolysis of the latter two, but was not entirely successful (Kopecky, *Chem. Prumsyl 14*, 291). Triphenyltetrazolium halides with sulfated or sulfonated surfactants, form water insoluble salts which can be extracted with ethylene bromide, the tetrazolium cation being deep red upon reduction (Renault and Bigot, *Ann. Pharm. Franc. 21*, 847). Standard titrants for the Epton titration such as phenoxy propane sulfonic acid salts are recommended (Heinerth, *Fette, Seifen, Anstrichmittel 64*, 841). The Epton method is used with Kristallponceaux 6R as indicator in textile processing control (Stoykovic and Kukoyec, *Tekstil 13*, 69).

Sulfonated coal is used to adsorb sodium alkyl sulfates for control analysis (Barsegyan and Solodova, *Tr. Nauchn.-Issled. Inst. Sintetich. Zhirozamenitelei i Moyushchikh Sredstv 1960* (1), 74). Benzidine hydrochloride is used for precipitating alkylarenesulfonates and the precipitate removed in a microcentrifuge followed by gravimetric determination (Maurmeyer and Rafalowitz, *Mikrochim. Ichnaonal. Acta 1964*(2–4), 561). Sodium alkylarenesulfonates are determined by an ultraviolet spectrophotometric procedure (Arpino and De Rosa, *Riv. Ital. Sostanze Grasse 39*, 386). Infrared spectroscopy was used in determining the branching of alkylbenzenesulfonate (Frazee and Crisler, *JAOCS 41,* 334). Fatty alcohol sulfates are determined in solution using a stalagmometric procedure (Lorinc et al., *Magy. Textiltech. 15,* 252). Determination of organic sulfates and sulfonates in very dilute solution was discussed, including interferometric and oscillographic-polarographic methods (Dolezil and Bulandr, *Freidberger Forschungsh.* A *316,* 141).

A rapid method for determining sodium sulfate present in alkylarenesulfonate is titration with lead nitrate in the presence of dithizone (Thom, *Tluszcze i Srodki Piorace 7,* 84). Determination of sulfate ion in the presence of alkylarenesulfonate is based upon precipitation of lead sulfate in acetone solution at pH 3 followed by titration with potassium ferrocyanide using potassium ferricyanide-Variamine Blue indicator (Gregorowicz et al., *Z. Anal. Chem. 199,* 207).

ANALYSIS OF CATIONIC SURFACTANTS. Perchloric acid titration of N-cetylpyridinium bromide in dioxane is made using Metanil Yellow as an indicator (Solomon-Ionescu et al., *Rev. Chim.* (Bucharest) *14,* 533). Organic bases and salts can be determined titrimetrically in nonaqueous solution (Feltkamp, *Deut. Apotheker.-Ztg. 101,* 207). A paper chromatographic method is used with ninhydrin for nitrogen containing compounds (Drewry, *Analyst 88,* 225). Cationic surfactants were determined by argentometry, alkalinimetry, iodometry, perchlorate titration, and flocculation analysis (Thoma et al., *Pharmazie 18,* 414).

An excess of a definite amount of potassium p-chlorobromobenzenesulfonate is added to a cationic surfactant, the resulting precipitate is removed after filtration and the excess of the precipitating agent is determined by measurement of extinction at 288.7 mμ and the amount of cationic surfactant calculated (Izawa et al., *Kogyo Kagaku Zasshi 66,* 1679).

ANALYSIS OF NONIONIC SURFACTANTS. Problems in analyzing nonionic surfactants are described in a review containing 127 references (Kopecky, *Chem. Listy 57,* 1153). Polyoxyethylene surfactants in industrial waste were determined using the Takayama method (Karapaev and Malkina, *Neftepererabotka i Neftekhim., Nauchn. Tekhn. Sb. 1963*(7), 9). The bismuthate sedimentric reagent method is used in determining trace amounts of oxyethylates and polyethylene glycols (Burger, *Z. Anal. Chem. 199,* 434). Rosen's qualitative test for polyoxyethylene and polyoxypropylene is modified to make it quantitative (Williams and Graham, *Anal. Chem. 36,* 1345). Polyoxyethylene surfactants are determined by salting out, treating with hydrogen iodide and the free iodine determined titrimetrically (Obruba, *Chem. Prumzsl 14,* 25). The ethylene oxide content of nonionic surfactants can be determined by a modified Zeisel-method or more quickly by IR-absorption at 2485 mμ. (Voogt, *Fette, Seifen, Anstrichmittel 65,* 964). Nonionic surfactant is separated on a mixed-bed resin, eluted, and determined by the method of Brown and Hayes (Weber et al., *Anal. Chem. 36,* 678). Thin-layer chromatography is used in identifying polyglycols (Seher, *Fette, Seifen, Anstrichmittel 66,* 371). Polyoxyethylene surfactants are determined by a complexometric titration using modified Dragendorff reagent and ethylene diaminetetraacetate (EDTA) (Alessandro, *Boll. Chim. Farm. 101,* 948). Infrared spectrophotometry is used to determine dimethylformamide in sucrose esters (Zajic and Bares, *J. Inst. Chem. Tech. Prague 7–2,* 215). Accurate analyses of the hydroxyethylation of ethylene oxide adducts are obtained by infrared spectrometry (Glassmann and Maennchen, *Fette, Seifen, Anstrichmittel 65,* 741). Hydroxyl numbers are rapidly determined spectrophotometrically, but no amino alcohol or mixture of an alcohol and amine can be analyzed because of mutual spectral interference (Brunelle and Crecelius, *Soap Chem. Specialties 39*(10), 63). A scheme for analysis of diethanolamides of fatty acids by titrimetric procedures is described (Szmidtgal et al., *Tluszcze i Strodki Piorace 7,* 17). Certain nonionic surfactants are susceptible to differentiation by color reactions on filter paper using various reagents (Nishida, *Seikagaku 32,* 467).

ANALYSIS OF MIXTURES. Identification and semiquantitative separation of surfactants are carried out by thin-layer and column chromatography (Desmond and Borden, *JAOCS 41,* 552). Various ionogenic and nonionic surfactants are separated on ion-exchange beds and analyzed photometrically (Izawa and Kimura, *Kogyo Kagaku Zasshi 66,* 1376). Analytical methods for separation of specific mixtures of surfactants are summarized and critically discussed (Blank and Kelley, *JAOCS 41,* 137).

A foam chromatography method potentially applicable to surfactants is described (Skrylev and Mokruskin, *Zh. Prikl. Khim. 37,* 211). The partition coefficients of various surfactants in aqueous isopropanol and petroleum ether were measured and a method using isopropanol for extracting the active components and petroleum ether for the inactive ones was proposed (Noshiro et al., *Kogyo Kagaku Zasshi 66,* 1206). Cationic and ampholytic surfactants are complexed with Orange II, extracted with chloroform, and analyzed colorimetrically (Kato et al., *Kogyo Kagaku Zasshi 66,* 1449). Cationic and anion-cation (betaine-like) surfactants are analyzed by forming large anion-cation species with thymolsulfonphthalein dyes, extraction with chloroform, back extraction into sulfuric acid, and photometric measurement at 555 mμ (Ruf, *Z. Anal. Chem. 204,* 344). Anionic surfactants in the presence of amine oxides are determined by quaternary titration with bromocresol green. The total amine oxide is then determined by adding a stoichiometric amount of quaternary to a second aliquot to react with the anionic, extracting the mixture with chloroform, then titrating the extracted amine oxides with a standard ABS solution and methylene blue indicator (Lew, *JAOCS 41,* 297).

MISCELLANEOUS ANALYSES. Determination of the desorption potential of some soaps and detergents by polarographic reduction of oxygen on a dropping mercury electrode was examined (Pasciak, *Roczniki Chem. 37,* 1233). A quantitative high-resolution proton magnetic resonance measurement was used for determination of average structures of surfactants. Accuracy is the order of ±2% of the total hydrogen (Crutchfield et al., *JAOCS 41,* 129). Analysis of surfactants was reviewed (Hummel, *Tenside 1*(2), 50). Surfactants were classified, the older qualitative tests reviewed, and a new paper chromatographic method outlined (Smith, *J. Soc. Cosmetic Chemists 14,* 513). A review of surfactant analysis appeared (Kimura and Izawa, *Yukagaku 13,* 177). Latest developments in surfactant analysis were reviewed (Johnson, *Mfg. Chemist 35*(9), 75). Mono-, di-, tri-, medium and high polyphosphates in detergents can be differentiated quantitatively by paper chromatography (Keubler, *Mitt. Gabiete Lenensen. Hyg. 54,* 478). Paper and thin-layer chromatography are used for separation and determination of phosphates in detergents (Heinerth, *Seifen-Oele-Fette-Wachse 90*(5), 105). Active oxygen in persulfates in the presence of percarbonates and perborates was determined by iodometric and colorimetric methods (Karvanek et al., *Sb. Vysoke Skoly Chem.-Technol. Praze, Oddil Fak. Potravinareske Technol. 4,* Pt. 1, 299). Values for active oxygen in detergents containing perborate may be up to 10% high owing to oxygen consumption by the organic surfactant. Errors are minimized by adding Reinhardt-Zimmerman solution (Milster and Meckel, *Seifen-Oele-Fette-Wachse 90,* 387). EDTA can be determined spectrophotometrically in the absence of phosphates by measuring the absorbance of ferric thiocyanate solution of pH 3 at 475 mμ, the absorbance decreasing linearly with increase in EDTA concentration (Parker, *Anal. Chem. 36,* 236). Flame spectrophotometry is used to determine sodium, potassium, and magnesium in surfactants (Beck et al., *JAOCS 40,* 515). A method designed for the determination of free alkali in soaps without causing appreciable saponification of neutral fats is based on titration of the soap in ethylene glycol-isopropanol solution, precipitating alkali carbonates with barium chloride (Malenicky and Pokorny, *Parfuem. Kosmetik 45,* 188). Colorimetric or spectrophotometric methods are used to determine trace metals in commercial soaps (Laury and Finel, *Rev. Frac. Corps Gras II,* 133).

PROPERTIES

ABSORPTION. The absorption rates of acetylene, carbon monoxide, and carbon dioxide in distilled water were studied as a function of the rates of stirring and the concentration of an alkylnaphthalenesulfonate and a nonionic surfactant (Bozhov and Elenkov, *Comp. Rend. Acad. Bulgare Sci. 16,* 277). The absorption of sulfur dioxide in water containing an alkylnaphthalenesulfonate or dodecylbenzenesulfonate (DDBS) varied with the type and concentration of surfactant, rate of stirring, shape of the vessel, and was strongly influenced by the system hydrodynamics (Elenkov et al., *Ibid., 16,* 269). Various alkyl sulfates were studied in the absorption of sulfur dioxide in their solutions, and it was concluded that the effect of the presence of surfactants and their concentration on the hydrodynamics of the liquid could not be deduced from their structure (Elenkov and Balarev, *Ibid., 16,* 153).

ADSORPTION. The structural strength of iron, ocher, calcium carbonate or magnesium powder suspensions in aliphatic and aromatic hydrocarbons increases greatly in volume concentration and is depressed by added surfactants (Konstantinova et al., *Kolloidn. Zh. 25,* 555). The elastic-kinetic properties of concentrated aqueous dispersions of kaolin were studied in relation to the type of surfactant additives with the Tolstoi apparatus, and the structural-mechanical properties were studied in a rotation-viscometer (Miskarli and Zemlyanskaya, *Dokl. Akad. Nauk Azerb. SSR 19*(17), 21). Electron microscope studies of some organic surfactants on polycrystalline films of rutile showed the collection of organic materials at active patches or sites on the surface (Cheever and Babalek, *Ind. Eng. Chem., Fundamentals 3*(2), 89). Rutile and aluminum phosphate were treated with surfactants and their mechanism of adsorption studied (Ermolaeva et al., *Lakokrasochyne Materialy i ikh Priminenie 1964*(2), 23). The adsorption isotherms for sodium oleate on TiO_2 and Zn O were studied. Near the critical concentration of micelle formation (cmc) and in higher concentrations several extreme points occur (Sakharova and Shutova, *Lakokrasochyne Materialy i ikh Primenenie 1964*(3), 23).

Adsorption of surfactants on quartz sand was investigated and the difference in adsorption of nonionic and anionic surfactants and their mixtures were described (Kravchenko et al., *Tr. Ufimsk. Neft. Nauch.-Issled. Inst. 1963*(9–10),194). Surfactant effect in demulsification was explained. Amounts of surfactants used to displace petroleum from strata consisting of argillaceous rocks were estimated with nonionic surfactants (Malysheva et al., *Primenenie Poverkhn.-Akitvn. Veshchestv v Neft. Prom., Ufimsk. Neft. Nauchn.-Issled. Inst., Tr. Vtorogo Vses. Soveshch. 1963,* 170). The adsorption of several nonionic surfactants from ligroin on various quartz sands was studied to learn more concerning the desorption of petroleum for greater recovery (Musaev et al., *Ibid, 1963,* 153). Changes in surface tension of aqueous anionic surfactant solutions due to adsorption on quartz sand was studied, the adsorption falling into three classes (Kravchenko et al., *Ibid, 1963,* 160). Aqueous suspensions of nonclay materials were stabilized by surfactants, sodium cellulose sulfate and cellulose ethane sulfonate (Yatrov et al., *Ibid, 1963,* 104). Dispersing agents of many types were reviewed and their effectiveness discussed (Negoro, *Kagaku* (Kyoto) *17, 419*).

Stabilization of dispersions by nonionic surfactants may be more effective than purely electro-stabilization and may be useful for making suspensions resistant to flocculation. The best stability should be obtained from large nonionic molecules or above cmc by those which form large micelles (Ottewill, *Proc. Congr. Intern. Federation Soc. Cosmet. Chemists,* London *1962,* 209). The dispersing and protective action of surfactants was reviewed (Endo and Fukushima, *Shizuoka Yakka Daigaku Kaigaku 10-Shumen Kinen Rombunshu 1963,* 174). Hydrous alumina floc was investigated for the effect of ABS in a study of its removal from water. Below pH 4.5 floc dissolved as a result of the formation of a monoaluminum hydroxy ABS complex (Sedlander, *Am. Chem. Soc., Div. Water Waste Chem., Preprints 1962*(Sept), 28). Adsorption on clean surfaces as atomic and molecular phenomena were discussed with relation to structure (Ehrlich, *Ann. N.Y. Acad. Sci. 101*(3), 722). A connection was shown between adsorption kinetics and capability to form micelles for esters of sulfosuccinic and sulfopropionic sodium salts (Smirnov and Levi, *Kolloidn. Zh. 26,* 350). The adsorption of amines and the oxidation of clean and amine prechemisorbed reduced iron surfaces were measured using continuous flowing gas mass spectrometry. Though the amines are good oxidation corrosion inhibitors for water solutions they are poor for iron oxidation in a dry atmosphere (Yao, *J. Phys. Chem. 68,* 101). The adsorption of surfactants at mercury-solution interfaces was reviewed (Morinaga, *Rev. Polarog.*(Kyoto), *9,* 97).

CLOUD POINT. The cloud point of pure monolauryl ethers of hexaethylene glycol was lowered by solubilization of higher fatty alcohols (Sugano, *Nippon Kagaku Zasshi 84,* 520). Lowering of the cloud point of nonionic surfactants depends on the magnitude, structure, and affinity of the added hydrocarbons, of fatty alcohols and glycerides (Fugazza, *Riv. Ital. Sostanze Grasse 39,* 567). An automatic device was used for determination of cloud points (Abum et al., *Water Res. Std. 4,* 26).

DETERGENCY. Saturated monocarboxylic acids in chromium complexes showed an energy minimum by surface tension measurements, at C_{12} corresponding to a maximum of wet soil repellency. Detergent values also are at a maximum with C_{12} normal sulfates, showing the relationship to the chromium complex (Herzog, *Abhandl. Deut. Akad. Wiss Berlin, Kl. Chem., Geol. Biol. 1963*(2), 123). Soaps of fatty acids from paraffin oxidation, from tallow, and rapeseed oil were compared for detergent property. Synthetic soaps of C_{12-16} being adequate detergents whereas those above or below these chain lengths were poor (Szmidtgal and Kobylinska, *Przemysal Chem. 43,* 101). Detergency of soaps of branched chain fatty acids was lower than for soaps of normal acids of the same number of carbon atoms. Other physico chemical measurements are given (Nevolin et al., *Tr. Vses. Nauchn.-Issled. Inst. Zhirov* No. *22,* 146).

The removal of a family of homologous fatty acid soils from a metal surface was measured, using two anionic and three nonionic types of surfactants. Neither surfactant HLB, nor adsorptive energy of the surfactant polar group alone, was responsible for the removal of the fatty acid soils. Other relationships are developed. In order of soil removing effectiveness, sodium DDBS was good, fatty acid soaps were poor as were certain of the nonionic surfactants (Mankowich, *U.S. Dept. Com., Office Tech. Serv., PB Rept. 181,355*). The behavior of calcium soaps and means for their control were discussed (Best, *Fette, Seifen, Anstrichmittel 65,* 762). Several fibers were soiled with various oily soils and washed with solutions of alkyl sulfates permitting a rating of the ease of soil removal from the fibers (Bespyatov and Lsehchenko, *Tr. Nauchn.-Issled. Inst. Sintetich. Zhirozamenitelei i Moyushchikh Sredstv 1962*(3), 34).

Fatty acid monoethanolamides improve the detergency of cetyl sulfate and Sulfanol NPI (Karnaukh et al., *Maslob.-Zhir. Prom. 30,* 16). Electrolytes and carboxymethylcellulose were found to improve the detergency of synthetic alcohols but monoalkylamides of synthetic C_{10-16} fatty acids did not (Bespyatov and Leshchenko, *Izv. Vysshikh Uchebn. Zavedenii, Pishchevaya Hechnol. 1964*(2), 62).

The influence of long-chain alcohol length upon the surfactant properties of alcohol ethoxylates, alcohol ether sulfates, and alcohol sulfates was studied. Best overall detergency is with the C_{16} derivatives though alcohol sulfates had significantly better detergency than formulations with sodium DDBS (Matson, *Soap Chem. Specialties 39*(11), 52).

The interaction of surfactants of similar but different structure was measured colorimetrically, chromatographically, and by electrophoresis. An aliphatic polyglycol ether mixed with its carboxymethylation product became solubilized by its carboxymethyl ether (Theimer, *Textil-Rundschau 19,* 301).

Scintillation counting of neutron activated kaolinite clay as a soil was used for comparison with a reflectance method. Application of the Kubelka-Munk equation relating reflectance of soil content of cotton fabric was experimentally confirmed (Netzel et al., *JAOCS 41,* 678). Radiotagged soils such as ^{14}C-tagged stearic acid and ^{32}P-tagged tristearyl phosphate were used to study fatty soil removal from cotton fabric (Zeidler, *Intern. Koloristenkongr. 4,* Budapest, *1962,* 141).

Ultrasonic exposure of ABS and alkyltoluene sulfonates resulted in their decomposition, this increasing linearly with increasing vibration intensity and time (Lur'e et al., *Vestn. Tekhn. i Ekon. Inform. Nauchn.-Issled. Inst. Tekhn.-Ekon. Issled, Gos. Kom. Sov. Min. SSSR po Khim. 1962*(9), 47). Removal of fatty films with ultrasound is studied for dynamics of removal, sequence of process, as well as for the rate of removal dependence upon film thickness (Obraztsov and Nozdrev, *Primenenie Ul'traakust. R. Issled. Veshchestva, Moscow, Sb. 1961*(15), 151). Factorial experiments were used in the study of soil removal by two levels of ultrasonic energy (Ford, *JAOCS 41,* 543). Ultrasonic irradiation in drycleaning solvent containing a cationic surfactant and water resulted in clean headlamp surfaces not obtained in their absence (Turner and Yeats, *Brit. 973,661*).

Rate of soil removal by multiple cycle washing with three artificially soiled cotton cloths was not a 1st-order rate process. Percent soil removal increased linearly with the log of cumulative wash time (Loeb et al., *JAOCS 41,* 120). Analysis of cleaning curves indicated their shape as similar to that obtained for the sum of two independent 1st-order processes occurring at different rates, attributable to two types of soil being removed simultaneously by 1st-order processes behaving independently of each other. Effect of age, temperature, and cleaning time on rates of removal are discussed (Bourne and Jennings, *ibid 40,* 517). Mass transfer of pigment soil from the fabric into the wash liquor was studied as a function of temperature, turbulence, and polyphosphate content. Phosphates reduce particle size by peptization, and mass transfer is not diffusion controlled at low temperature (Kretzchmar, *Fette, Seifen, Anstrichmittel 66,* 222). The velocity of detergent action at high temperatures declines strongly in systems of cotton fibers soiled with India ink and mineral and Neat's foot oil, washed in a special washer with alkyl sulfates. Detergent removal is most likely impaired by changed adsorption of the alkyl sulfate molecules (Kretzchmar, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963*(2), 181). In alkaline cleaning solutions containing either a primary alcohol sulfate, a straight chain ABS, or a fatty acid soap, detergent efficiency is increased synergistically by addition of nonionic agents whose HLB lie within certain ranges. In such cleaners increasing detergency for the asphalt soil is directly related to increasing surface tension and cmc of the unbuilt surfactants (Mankowich, *JAOCS 41,* 47). The relation between detergency and cmc for mixtures of alkyl sulfates with electrolyte builders was investigated (Bespyatov and Leshchenko, *Maslob.-Zhir.*

Prom. 29(9), 19). Ethanolamides (10%) added to synthetic fatty acid soaps increased detergency 9 to 16% (Volkova and Shablina, *Maslob.-Zhir. Prom. 30*(6), 31). Detergents of ABS (Sulfanol) type improved the wetting, detergency and other characteristics of alkali salt solutions (Knafel'man, *Molschn. Prom. 24*(10), 29). Mixtures of 90% of the soaps made from the product of oxidation of normal paraffinic hydrocarbons and 10% of alkyl sulfonates or sulfates showed 1.5 to 2 times the detergent efficiency of the pure compounds alone (Ashimov et al., *Azerb. Khim. Zh. 1963*(3), 87). Mixtures of soap with sperm oil fatty alcohol sulfate, alcohols from fatty acids, DDBS and neutral oil-free alcohol sulfate were at an optimum for detergency at a 1:1 ratio (Szeplaky, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963*(2), 48).

The detergency of mixtures of polyoxyethylene nonylphenyl ether containing 10 ethylene oxide groups with sodium DDBS was lower when a small amount of the ABS was used. This was explained on the basis of a change in the nonionic micelle (Kame et al., *Yukagaku 13,* 20). Optimum detergency and surface activity was attained with sodium dialkyl phosphates as the didecyl hydrogen phosphate salts. Several phosphates were investigated and their physical and surface active property presented (Cooper and Urfer, *JAOCS 41,* 337). Detergency as a function of shrinkage in scouring was investigated and this was related to several alkyl sulfates, ABS, and soap. The shrinkage was highest with alkyl sulfates at a concentration just below cmc (Sakai and Komori, *Yukagaku 13,* 275). The effect on detergency of anionic-polymer mixtures was investigated for soap, sodium lauryl sulfate and sodium DDBS. Polymers used were sodium carboxymethylcellulose and polyvinyl alcohol-polyvinyl acetate (Matsukawa, *Kogyo Kagaku Zasshi 63,* 1030). Detergents were compared in a washing machine and visual results rated alkyl sulfonates best, then C_{10-18} alkyl sulfates, secondary alkyl sulfates, alkylmonosulfonates, and alkylarenesulfonates (Schwarzkopf and Wesch, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963*(2), 228).

ELECTRICAL. Anionic, cationic, and nonionic surfactants were examined on filter paper for their electrophoretic and electroosmotic character (Achiwa, *Shigakenritsu Tanki Diagaku Gakeijutsu Zasshi* No. *5,* 4). Electrokinetic effects influencing detergency were examined for solid and oily particles and while these effects are important to dispersion and emulsification they are not necessarily sufficient conditions for removing oily soil from glass (Ginn et al., *JAOCS 41,* 112). As with Ginn et al., association was found between electrokinetic constant and the log of concentration, the cmc being obtainable by graphic interpolation (Ranny, *Collection Czech. Chem. Commun. 24,* 3090). Electrophoretic studies were made of the particles of polystyrene emulsion prepared by using Tween 80 and sodium oleate as emulsifiers (Matsumoto and Tokuhara, *Kobunshi Kagaku 20*(224), 747). Electrical double layers in nonionic surfactant solutions were studied with the dropping mercury electrode (Watanabe et al., *Kolloid.-Z. 193,* 39).

The electrocapillary properties of some ampholytes were studied. No parallelism was found between dielectric potential and surface tension (Zapior, *Zeszyty Nauk. Univ. Jagiel., Ser. Nauk. Chem. 6,* 5). The dielectric character of surfactants in benzene was investigated (Olgerts, *Univ. Microfilms, Order No.* 64-4527). The thermal change of water of hydration water in sodium soaps of C_6–C_{18} was studied to investigate the states of combined water (Noguchi and Nishina, *Nippon Nogei Kagaku Kaishi 35,* 1086).

The electrical conductivity of plastic sodium soap systems was determined under a number of conditions (Deinega et al., *Kolloidn. Zh. 26,* 296).

EMULSIFICATION. Several cationic and anionic surfactants were investigated in the nonaqueous system, olive oil in glycerol (McMahon et al., *J. Pharm. Sci. 52,* 1163). The behavior of the oil-water interfacial film as affected by forcing a platinum ring through the system is discussed (Muenzel and Zwicky, *Sci. Pharm. 32,* 111). Water-in-liquid paraffin systems stabilized by nonionic surfactants were examined and their rheological properties discussed (Sherman, Rheol. Emulsions, *Proc. Symp., Harrogate,* England, *1962,* 73). The basic mechanism for interfacial breakup in the two bulk phases of an emulsion is examined (Gophal, *Ibid, 1962,* 15). Oil-in-water type emulsions from fatty acid glycerides and higher alcohols were prepared at high temperatures and their rheological properties examined (Matsumoto, *Kogyo Kagaku Zasshi 67,* 313). Emulsion stability as affected by electrolytes was examined using the ultracentrifuge. Stability was related to specific interfacial emulsion areas and adsorption of emulsifier at the emulsion droplet interface (Vold and Groot, *J. Colloid Sci. 19,* 384). The rate of coalescence of flocculating emulsions of water-in-oil was measured by using a two-component dye, one in the oil and the other in the water (Lucessen-Reynders, *Kolloid-Z. 197,* 137). The preparation of emulsions using sucrose stearates was extensively investigated, their solubility being greater in hydrophobic substances than in water (Orlova et al., *Trudy Vniiz 23,* 286). Nonionic surfactants were investigated for forming fungicidal oil emulsions (Kranz, *X. Pflanzenkrank. Pflanzenschutz 71,* 405). Nonionic surfactants were claimed as emulsifiers in agricultural emulsifiable concentrates (Surgent, *U.S. 3,141,775*).

Two nonionic surfactants were used as emulsion breakers for crude petroleum emulsions (Sereda, *Nefteperarabotka i Neftekhim., Nauchn.-Tekhn. Sb. 1963*(8), 9). An oxyethylated fatty acid was used for desalting crude oil, and the waste waters from electrohydration examined for demulsifier (Kazantsev et al., *Ibid, 1964*(4), 10). The demulsification of water-in-oil emulsions was studied and the kinetics discussed (Liu and Wang, *Hua Hsueh Hsueh Pao 30,* 153). Various polyglycol ethers of alkylphenols were used as demulsifiers of petroleum emulsions. The relation was established between HLB and demulsifying capacity (Petrov and Smirnov, *Primenenie Poverkhn.-Aktivn. Veshchestv v Neft. Prom. Ufimsk. Neft. Nauchn.-Issled. Inst., Tr. Vtorogo Vses. Seveshch. 1963,* 202). The structure dependence of demulsifying ability of polyethylene glycol esters of various fatty acids was determined (Nikolaeva and Levchenko, *Khim. i Tekhnol. Topliv i Masel 9*(9), 26). Emulsion breaking capability of polyoxyethylene synthetic higher fatty acids increases with increase in ethylene oxide content (Levchenko and Nikolaeva, *Ibid., 1963,* 195). The yield of petroleum from quartz sand, sandstone, limestone and dolomite was increased by adding nonionic surfactants to cationic agents, the excessive adsorption of the latter on rocks being reduced or eliminated (Kravchenko et al., *Premenenie Poverkhn.-Aktivn. Veshchestv v Neft. Prom., Ufimsk. Neft. Nauchn.-Issled. Inst., Tr. Vtorogo Vses Sovesch. 1963,* 65). Commercially available emulsifiers and their applications are listed (Carrière, *Riv. Ital. Sostanze Grasse 41,* 165).

FOAM. Mathematical experiments with a multistage form-separation apparatus with interchangeable units for the quantitative separation of foams in closed systems led to a general equation covering the system (Kashimoto, *Kolloid-Z. 192,* 66). The effect of the foam-liquid solution interface on continuous flush separation was studied (Grieves and Wood, *Nature 200,* 332). Thickness of films drawn from solutions of nonionic surfactants and neutral electrolytes were observed with an apparatus to measure the light rejection by the thin film (Duyvis and Overbeek, *Konindikl. Ned. Akad. Wetenschap., Proc. Ser. B 65,* 26). Peculiarities of foam lamella are described including formation, thinning, complementary pressure, kinetic stability, critical and equilibrium thickness, nature and thickness of black films, and foam stability (Shedluko, *Ibid., 64,* 76). A study was made of the dependence of surface tension and foam life on concentration of nonionic and anionic surfactants. Black spot formation coincides with the sharp upturn of the foam life curve and with the bend in the surface tension curve (Ekserova and Sheludko, *Izv. Inst. Fizikokhim., Bulgar. Akad. Nauk. 3,* 79). Foam stability of saponins, alkylarenesulfoates and sulfosuccinates was studied using a platinum ring technic (Zatova and Trapeznikov, *Kolloidn. Zh. 26,* 312). A lecture was given on syndet films (Kling and Lange, *Fachorgan Textilveredlung 19,* 162). Foam stability, foaming ability, wetting and density as functions of the degree of oxethylation of alkylphenols, alkylcresols, polyglycol ethers, polyglycol alkyl ethers and polyoxyethylated alkylphenol formaldehyde resins were measured (Popescu and Basarebescu, *Rev. Chim.* (Bucharest) *14,* 400).

Light scattering of soap films was measured and a theory presented taking into account the interference of the reflected incident beam with its multiple reflections and refractions, as well as the interference produced by the scattered beam (Vrij, *J. Colloid Sci. 19,* 1). Physical and chemical forces operating in thin liquid films were discussed and methods described (Kitchener, *Endeavor 22*(87), 118). The effect produced by ABS upon oxygen bubble size, shape, velocity, path and others were determined. Overall oxygen transfer coefficient varied directly with gas flow rate at all ABS concentrations but decreased with ABS concentrations at a given gas flow rate (McKeown and Okun, *Air Water Pollution 5,* 113). Velocity of ascent and lifetime of air bubbles in aqueous solutions of sodium dodecyl sulfate were studied as functions of concentration and orifice radius. Bubble stability and ascent retardation were dependent upon surfactant concentration (Okazari, *Bull. Chem. Soc.* Japan *37*(2), 144).

Foam stability was discussed based upon either the life of the individual soap film or the rate of decrease of total liquid/air interface. An acoustic measurement of film rupture was described (Schwarz, *Fette, Seifen, Anstrichmittel 66,* 380).

A dynamic method for measuring foam stability of nondisperse nitrogen foams from sodium laurate and sodium lauryl sulfate containing traces of lauryl alcohol is described. The relation between foam stability and adsorption of the surfactant at the boundary film was examined (Ruyssen and Joos, *Mededel. Koninkl. Vlaam. Acad. Wetenschap., Belg. 25*(3), 32). The mechanism of foam stabilization through added emulsifiers was discussed (Vader, *Fette, Seifen, Anstrichmittel 66,* 47).

Over 400 surfactants were evaluated as foaming agents for aerosol usage by determining emulsion stability and viscosity, density, foam stiffness, stability and discharge characteristics (Sanders, *Soap Perfumery Cosmetics 37,* 141). Claimed as foam producers for aerosol usage were compositions comprising alcohol, water, surfactant and propellant (Klausner, *U.S. 3,131,152–3,* and *–4*). Drop weight and bubble pressure methods were used in measuring the surface tension, and nitrogen bubbled through the solutions to measure the foaming characteristics of tetrahydronaphthalenesulfonic acid and their salts (Kloubek and Kondelik, *J. Prakt. Chem. 22,* 77). Fine-froth stabilizers in nonaqueous media of polyvinyl chloride plastics were investigated to find appropriate surfactants, the most effective proving to be phosphatides, ABS, alkanesulfonates, sucrose esters, and glycero fluoro acid esters (Tarakanova and Eremina, *Kolloidn. Zh. 25,* 569). Foaming of sodium DDBS was inhibited by using alkylisothiuronium salts (Saito et al., *Kogyo Kagaku Zasshi 67,* 508). Various silicones were discussed as antifoaming agents (Jakubowski, *Am. J. Hosp. Pharm. 21*(Feb), 60). Polyethylene amines which were reacted with trimethylolphenol and further acylated were claimed as antifoaming agents (DeGroote and Shen, *U.S. 3,127,354*). An improved defoamer for practically all types of surfactants was claimed by blending a silicone defoamer with alkylene oxide adducts of primary and secondary long-chain amines oxyalkylated with alkylene oxide (Marsh et al., *Brit. 964,837*). Addition of three to four parts of a tertiary amine containing an alkylene oxide to one part silicone antifoamant greatly enhances its properties as an antifoamant (Armour and Co. *Fr. 1,335,080*). Foams containing sulfur are broken by adding alkylarenesulfonates having higher surface activity than the foam-forming surfactant used in flotation (Szymanska and Sideuzycki, *Pol. 47,660*). Benzyl ethers of polyoxyalkylenes are claimed as effective antifoaming agents (Brunelle et al., *Belg. 624,833*). Foams and free liquid films were reviewed (Kitchener, *Recent Progr. Surface Sci. 1,* 51).

EFFECT OF HEAT. Thermal decomposition of cationic surfactants having a long alkyl chain occurred at 180C. Thermal stability in decreasing order were I^-, Br^-, Cl^-, F^-, and organic acid salts had poor heat stability (Yamamoto et al., *Yukagaku 12,* 524). X-ray diffraction studies of the structural changes in sodium stearate and laurate were made at temperatures up to 300C (Ogino, *Kogyo Kagaku Zasshi 67,* 1032). The influence of heat treatment of commercial soap upon solubility and capacity for swelling was investigated. Heat treatment did not change solubility but increased swelling of individual particles (Dervichian, *Soap, Perfumery & Cosmetics 33,* 1061).

HYDROPHILE-LIPOPHILE BALANCE (HLB). Various methods for determination of HLB were reviewed (Sirovica, *Archiv. Farm.* (Belgrade) *13,* 181), and surfactant characterization by this means was discussed (Kassem, *Pharm. Ztg., Ver. Apotheker-Ztg. 108*(36), 1175). The Griffin formula HLB = 20 [1–(S/A)] was said not to be applicable to emulsifying agents in general and examples were given (Neuwald, *Sci. Pharm. 32,* 142). Surfactant HLB values may be determined by gas-liquid chromatography (Becher and Birkmeier, *JAOCS 41,* 169). A modified apparatus for measuring the resistance-temperature of an emulsion is described and HLB values from the curve determined (Aoki et al., *Yukagaku Zasshi 83,* 1132).

INTERACTION. The interaction between nonionic surfactants and various dyes was studied by capillary analysis on filter paper (Hayama, *Nippon Kagaku Zasshi 84,* 948). The condensate of 29.8 moles of ethylene oxide with one mole of octadecylamine was added to 393 different commercial dyes and changes of color examined to show complex formation. Shift of absorption maxima were classified for the various dye types (Nemoto et al., *Nagoyashi Kogyo Kenkyusho Kenkyu Hikoku* No. *24,* 63). Interactions between Orange II and various cationic surfactants were investigated. In the presence of excess common surfactant micellar solubilization of the dye-surfactant compounds occurs (Zografi et al., *J. Pharm. Sci. 53,* 544).

MICELLES. The conductometric method was used in determining the cmc of various soda soaps and hexadecyl sulfate from 5 to 90C (Markina et al., *Kolloidn. Zh. 26*(1), 76). The cmc of secondary alkyl sulfonates from the condensate of a specific petroleum deposit was determined by a pinacyanol chloride method, the effect of electrolytes being determined (Bespyatov and Volkova, *Tr. Khar'kovsk. Politekhn. Inst. 39,* 41). The cmc of tetrahydroanacardol ammonium monosulfonate was between 0.0075 and 0.01g/100 ml determined conductometrically (Katti and Kulkarni, *Indian J. Technol. 2*(3), 96). Variations in pH of aqueous solutions of bivalent metal salts of dodecyl sulfate below and above cmc were studied. All curves showed a break at the cmc (Satake et al., *Mem. Fac. Sci. Kuyushi Univ. Ser.* C, *5*(3), 65). The self diffusion of the sodium ion can be explained in terms of the electrostatic potentials existing in micellar solutions of sodium dodecyl sulfate micelles without postulating any specific ion binding (Clifford and Pethica, *Trans. Faraday Soc. 60*(493), Pt. 1, 216). Micelle formation and gegen ion binding of aqueous solutions of primary and quaternary ammonium dodecyl sulfates were studied conductometrically. Cmc decreased with increase in cation chain length (Packter and Donbrow, *J. Pharm. Pharmacol. 15,* 317). The cmc of dodecyl pyridinium bromide from 5 to 70C was measured conductometrically (Alderson and Taylor, *J. Colloid Sci. 19,* 495). The solubility curves of N-cetyl-alpha, beta, and gamma-picolinium chlorides and bromides in acetone and benzene from 5 to 70C were determined, the curves showing an inflection at cmc (Angelescu et al., *Acad. Rep. Populare Romine, Studii Cercetari Chim. 11,* 193).

The equations of Princen and Mysels for the effect of addition of electrolyte on light scattering by colloidal electrolytes were extended to the case of simple ions of any charge, using a number of quaternary ammonium salts (Wasik and Hubbard, *J. Res. Natl. Bur. Standards* A*68,* 359). Micellar molecular weights and cmc of the homogeneous phase of the coacervating Hyamine 1622 system as a function of sodium chloride concentration and temperature were determined from light scattering and refractive index measurements (Cohen and Economou, *JAOCS 41,* 461). Cmc values of nonionic surfactants were determined by surface tension and spectrometry of iodine solutions and the effect of the alkyl and polyglycol chain length of some monoalkyl polyethers established (Carless et al., *J. Colloid Sci. 19,* 201). The surface properties and micellar character of some glucosyl alkylbenzenes and glycosyl alkanes were measured (Hutchison et al., *J. Phys. Chem. 68,* 2818). Intrinsic viscosities, sedimentation coefficients and diffusion constants were used to determine the size, shape, and hydration of nonionic dimethyldodecylamine oxide and sodium dodecyl sulfate micelles (Courchene, *J. Phys. Chem. 68,* 1870). Light scattering and sedimentation methods were used to determine the micellar properties of dimethyldodecylamine oxide-sodium halide-water systems (Herrmann, *Ibid., 68,* 1540). An empirical method based upon vapor pressure measurements over concentrated gels and solutions of nonionic surfactants was used for estimating micellar hydration (Elworthy and Macfarlane, *J. Chem. Soc. 1964,* 311). The refractometric method agreed reasonably well with other methods for determining the cmc of nonionic surfactants (Donbrow and Jan, *J. Pharm. Pharmacol. 15,* 825). The water solution curve of nonionic alkylphenol-formaldehyde condensates showed a break in the concentration-absorbance curve and cmc values determined by other means agreed with this (Hayano et al., *Yukagaku 13,* 33).

Light scattering, viscosity and vapor phase data from hexadecyl alcohol polyethenoxy type detergents show micellar weights and intrinsic viscosities increasing with increasing temperatures (Elworthy et al., *Kolloid.-Z. 195,* 16). The cmc and thermodynamics of some branched chain alkylol polyethenoxy nonionics were studied. The effect of concentration and temperature on micellar size of normal-alkyl hexaethylene glycol monoethers was investigated by light scattering. The heat of micelle formation was also determined (Balmbra et al., *Trans. Faraday Soc. 60,* 979). Several nonionic surfactants in benzene failed to form micelles but their number-average micellar weights in water were determined by light scattering (Sirianne and Coleman, *Can. J. Chem. 42,* 682). The thermodynamics of micellization of normal alkyl tri-, hexa-, and nonaoxyethylene glycol monoethers were examined (Corkell et al., *Trans. Faraday Soc. 60,* Pt. 1, 202). Surface tension and cmc values for polyglycol ethers of alkylphenols were determined (Petrov et al., *Tr. Gos. Inst. po Procktri. i Issled. Rabotam Neftedob. Prom. "Giprovostokneft," 1963*(6), 12). Equilibrium ultracentrifugation and light scattering of sodium lauryl sulfate and dodecyltrimethylammonium bromide were used in characterizing their micellar properties (Anaker et al., *J. Phys. Chem. 68,* 81). The role of hydration in micellar solutions was discussed (Mukerjee, *J. Colloid Sci. 19,* 722). The effect of dodecyl hexaethylene glycol monoether on the micellization of sodium dodecylsulfonate was investigated. Below a critical concentration the surfactant anions are adsorbed by the nonionic micelles, while above this concentration mixed micelles of constant composition are formed (Corkill et al., *Trans. Faraday Soc. 60,* 986). Correlation between mixed micelles of anionic-cationic with detergency showed increases in the latter with increasing charge on, and number of anionic monomers in the mixed micelles (Mankowich, *JAOCS 41,* 449). Nuclear magnetic resonance measurements of sodium alkyl sulfate were made and the structure of the surfactant solution discussed (Clifford and Pethica, *Trans. Faraday Soc., 60,* 1483). The proton magnetic resonance spectrum of benzene molecules exchanging between surfactant micelles and the water phases was analyzed (Nakagawa and Tori, *Kolloid.-Z. 194,* 143). High resolution electron microscopy of several sodium ligno sulfonate fractions showed agreement of weight-average particle weight with sedimentation equilibrium molecular weights (Rezanovich et al., *J. Appl. Polymer Sci. 8,* 1801). Cmc concentrations of several types of surfactants were studied polarographically (Malik and Haque, *Indian J. Chem. 2,* 35).

Soap Structure. Binary mixtures of saturated soap of even-numbered carbon atoms examined by x-ray diffraction showed that with increasing values of the relative difference in carbon numbers solid solutions formed first, then molecular association in definite proportions and finally separate crystallization of the constituents (Lecuyer and Dervichian, *Kolloid.-Z. 197,* 115). The structure of potassium soap gels was investigated by X-ray diffraction (Vincent and Skoulios, *Compt. Rend. 258,* 1229). Binary sodium soap systems were investigated by X-ray diffraction (Ogino, *Kogyo Kagaku Zasshi 66,* 1216). The phase transition of binary soaps of normal fatty acids was studied by differential thermal analysis (Ogino, *Ibid., 67,* 597). Infrared wave numbers were used to characterize acid sodium soaps in alcoholic solution (Dunken and Winter, *Z. Chem. 4,* 311).

Solubilization. The solubilizing power and other characteristics of both a polysoap such as the n-dodecyl bromide adduct with poly(2-vinylpyridine) and a monosoap, e.g., n-dodecyl bromide adduct with alpha-picoline solutions for oil soluble dyes were determined (Tokiva, *Bull. Chem. Soc.* Japan *36,* 1589). Solubilization of hydrocarbons and long chain alcohols in solutions of quaternary polysoaps were examined by light scattering (Inoue, *Kolloid.-Z. 196,* 1). Six weak anionic polysoaps from a copolymer of maleic anhydride and dodecyl vinyl ether were studied for viscosity and solubilization, the effect of the counter-ion being elaborated (Ito et al., *J. Colloid Sci. 19,* 28). Four anionic polysoaps varying in alkyl group lengths and molecular weights prepared from copolymers of maleic anhydride and dodecyl or octadecyl vinyl ether were measured for viscosity and solubilization characteristics (Ito, *Ibid. 19,* 152).

A turbidometric method was used to measure the solubilizing power of aqueous alkyl sulfate solutions for oleic acid, a synthetic mixture of hydrocarbons, and alcohols (Bespyatov and Leshchenko, *Tr. Nauchn.-Issled. Inst. Sintetich. Zhirozamenitelei i Moyushchikh Sredstv 1962*(3), 29). Doubt is thrown on the concept of solubilization by experiments with isobutane-isopropane mixtures in water containing highly purified soap, since curves of gas pressure versus the hydrocarbon mixture were the same in both the soap solution and water (Tobolsky and Ludwig, *Am. Scientist 51,* 400). Preservatives in nonionic surfactant solutions are solubilized, hence inactivated (Evans, *J. Pharm. Pharmacol. 16,* 323). The solubilizing powers of higher glyceryl alpha, alpha′-diethers were measured and the effect of structure discussed (Kameyama, *Kogyo Kagaku Zasshi, 67,* 922). The solubilization and autoemulsification of water into benzene solutions of nonionic surfactants were determined by a layering method (Nakagaki and Sone, *Yakugaku Zasshi, 84,* 151). Gas chromatography, nephelometric, and viscometric methods were used in detecting the presence of solubilizates in anionic and nonionic surfactant solutions (Matsumoto, *Nippon Kagaku Zasshi 85,* 83). Gas-liquid chromatography was used to study the solubilization of polar species by micelle-forming magnesium dinonylnaphthalenesulfonates in a nonpolar solvent (Kaufman, *J. Phys. Chem. 68,* 2814).

Surface Tension and Surface Properties. The meaning of the slope of surface tension vs. log concentration under various conditions was analyzed thermodynamically (Shinoda and Nakayama, *J. Colloid Sci., 18,* 705). The equilibrium of surface tension with hydrostatic pressure in capillary systems was investigated (Chifu, *Studia Univ. Babes-Bolyai, Ser. Chimia 8,* 49). Several ampholytic surfactants in aqueous solution were pH adjusted and the effects on surface tension measured (Inanu and Wada, *Kogyo-Shoreikan Hokoku* No. *26,* 45). The surface tension of ammonium caprylate and caprate were measured by the ring method, showing cmc values, temperature dependence, and effect of excess ammonia (Han and Lee, *Doehan Hwahak Hwoejee 7,* 277). The relation between constitution and surface activity for several alkylbenzenesulfonates was based upon surface tension, cmc by conductance, foam and the effect of water hardness (Asinger et al., *J. Prakt. Chim. 23,* 89). A comparison was made between sucrose esters and ether emulsifiers by means of surface and interfacial tension measurements (Orlova et al., *Trudy Vniiz 23,* 298). The surface activity of saccharose mono- and distearate and of lecithin and monoglyceride stearates were compared by surface and interfacial tension measurements at different temperatures (Orlova et al., *Tr. Vses. Nauchn.-Issled. Inst. Zhirov 1963*(23), 298). Surface and interfacial tension measurements of nonionic and anionic surfactants were related to the wetting angle on quartz (Tairov, *Primenenie Poverkhn.-Aktivn. Veshchestv v Neft. Nauchn.-Issled. Inst., Tr. Vtorogo Vses. Soveshch. 1963,* 146). An automatic device based upon a platinum stirrup pulled from the solution is used to measure surface or interfacial tensions (Hilton et al., *Soap Chem. Specialties 40*(3), 48). Hydrophobic rings such as platinum coated with polyethylene or Teflon are used to measure interfacial tensions (Krynitsky and Garrett, *J. Colloid Sci. 18,* 893). The validity of surface tension measurements is based upon an equation utilizing specific surface tension of the solution and its components and the mole fraction of the second component (Tatarskaya, *Zap. Leningr. Gorn. Inst., 43*(3), 47). A strain gage attached to continuous recording apparatus was used to measure changes as surfactant films were extended and retracted to show the various states resulting from such measurements (Grabenstetter and Corkill, *J. Colloid Sci. 18,* 401). A capillary pressure method was used to measure the surface tension of various types of surfactants. A technic is described to prevent evaporation and condensation of volatile surfactants during surface tension measurement (Guastalla, *Compt. Rend. 258,* 900). Radioisotopes were used to investigate the surface mobility of surface-active substances (Chifu and Oniciu, *Studia Univ. Babes-Bolyai, Ser. Chemia 9,* 95). A method capable of measuring the surface tension of samples as small as 10^{-4} ml is based on the inequality of surface pressures of a liquid column contained in a conical capillary (Heller, *J. Chem. Phys. 40,* 3292).

Surface tension, cmc, wetting, emulsifying and detergent properties of Sulfanol NP were compared with those of alkyl sulfate (Nikitina and Spiridonova, *Kolloid. Z. 25,* 581). The surface tension, emulsification, and foam heights were measured for sodium salts of anacardic acids of varying unsaturation (Biswas and Ray, *Nature 200,* 1203). 5ven-chain alkanesulfonates, odd-chain alkane sulfonates (from alpha-sulfo carboxylic acid decarboxylation) and 1-hydroxy-2-alkane sulfonates from the reduction of alpha-sulfo acids were compared as to Krafft point, cmc, detergency and foam height. Data are discussed (Weil et al., *JAOCS 40,* 538). Primary and secondary tetradecyl sulfonates with the polar group in different positions were studied. Detergent capacity decreased and surface tension increased as the polar group was moved to the end of the hydrocarbon chain (Karnaukh et al., *Sb. Statei o Robatakh Ukr. Nauchn.-Issled. Inst. Maslozhir. Prom. za 1959–1961,* Kharkov Nos. 4–5, 58). The physico-chemical properties of individual normal monoalkyl sulfates of dodecyl and octadecyl alcohols were measured (Karnaukh Deinekhovskaya, *Bs. Statei o Rabotakh Ukr. Nauchn.-Issled. Inst. Maslozhir. Prom. za 1959–1961,* Kharkov Nos. 4–5, 47). The properties of synthetic fatty alcohol sulfates were measured for surface tension, cmc, wetting, detergency, foaming, foam stability, solvent solubility, resistance to hydrolysis and storage behavior (Lesyuis et al., *Maslob.-Zhir. Prom. 29*(8), 22). Surface tension, interfacial tension, wetting, foaming, emulsification, and detergency values were measured for symmetrical secondary alcohol sulfates (Shimokai and Fukushima, *Yukagaku 12,* 516). The surface activity, wetting, and hard water properties of sulfonate surfactants from glycidyl and glyceryl ethers were measured (Kuwamura, *Kogyo Kagaku Zasshi 66,* 215). Various alkylmercaptan derivatives were prepared and tested for solubility, surface tension, foam, and cmc (Inami and Wada, *Osaka Furitsu Kogyo-Shoreik in Hokoku* No. *26,* 42).

Foam height and surface activity were measured for a number of sodium alkylurea-N-methanesulfonates (Komori et al., *Kogyo Kagaku Zasshi 66,* 693). A comparison based on wetting, foam, lime soap dispersion and detergency was made between Mepasin sulfanilide sulfonate and other anionic sulfates, sulfonates, and an anionic surfactant (Chmell, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963,* 81). A relation is found between surface activity of a soap and its fatty acid constituents. Other relationships for alkyl sulfates, dialkylsulfosuccinates, alkylarenesulfonates and ethylene oxide derivatives were studied. Wetting has only slight relation to micellar constitution of the system (Gerault, *Congr. 7,* 119). The structures of alkoxyalkylbenzenesulfonates were related to their surface active properties (Sathi and Rao, *Indian J. Chem. 2*, 277). A series of dialkylbenzenesulfonates was synthesized and surface properties and detergency studied. Relation of structure to activity was made (Faingol'd et al., *Tr. Vses. Nauchn.-Issled. Inst. Zhirov 1963*, 205). Chemical and physical constants for cationic and nonionic surfactants containing nitrogen were listed and discussed (Herring, *Soap, Perfumery, Cosmetics 36*, 889). Carefully purified p-tert-octylphenoxyethoxyethanols were examined for molecular weight distribution. Their foam, wetting, detergency, emulsification and solubility properties were determined (Crook et al., *JAOCS 41*, 231). HLB, wetting, foaming, emulsification, and detergency of sucrose fatty acid esters and other sugar esters were reviewed and compared with oxyethylated derivatives (Passedouet, *Riv. Ital. Sostanze Grasse 39*, 464). Long-chain alphaphosphono fatty acids, esters, and salts were prepared and evaluated for hard water stability, wetting, foaming, detergency, acid hydrolysis and other properties (Mauer, *JAOCS 41*, 206). The properties of alkali metal carboxylates in hydrocarbons were extensively investigated (Kissa, *J. Colloid Sci. 19*, 279).

MISCELLANEOUS PROPERTIES. The effect on the viscosity of polyethylene glycol sorbitan oleate mixtures by added alcohol was studied (Vogt and Dillman, *Pharm. Ind. 25*, 731). The viscosity of sodium soaps of disproportionated rosin varied considerably depending upon the stirring rate. Temperature dependence was defined by an equation (Khoroshin et al., *Kauchuk i Rezina 23*(7), 21). The influence of soap chain length on the maximum viscosity of soap-cresol systems was investigated (Angelescu and Popescu, *Kolloid Z. 191*, 130. Surfactants at the boundary phase of mercury-xylene systems were shown to affect droplet stability as shown by boundary plane shearing viscosity measurements (Sonntag, *Z. Physik. Chem.* (Leipzig) *225*, 284). The effect of surfactant on the flow rate of the gas-liquid boundary layer was determined using solid particles such as aluminum powder to trace movement (Balarev, *Compt. Rend. Acad. Bulgare Sci. 16*, 157). The solubility of quaternaries and their amine-soap products in kerosine were studied using a method for measuring their solutions at the hydrocarbon interface to determine surfactant concentration (Kravchenko and Sharina, *Tr. Ufimsk. Neft. Nauchn.-Issled. Inst. 1963*(9–10), 189). The solubility behavior of alkali metal dinonylnaphthalenesulfonates in nonpolar and in low-polarity solvents was studied. The results indicated that in the low-polarity media the outer micellar sheath determines solvent compatibility (Little and Singleterry, *U.S. Dept. Com., Office Tech. Serv., AD 424,577*). Phase diagrams of several alcohol polyoxyethylene surfactants with chloroxylenol were obtained, showing the formation of liquid crystals of the nonionic ethers and in one instance a region of three isotropic liquid phases (Mulley and Metcalf, *J. Colloid Sci. 19*, 501). Pressure-area measurements were made of quaternary ammonium stearates in the presence of quaternary ammonium hydroxide (Pauley et al., *Ibid. 19*, 602). The charge properties of several coacervating surfactant-electrolyte systems were examined (Cohen and Libackyj, *Ibid., 19*, 560). The capillary chromatographic method was used to show the resistance to coagulation of polyvinyl alcohol emulsions stabilized by nonionic surfactants (Hayashi et al., *Yukagaku 12*, 501). The moistening capacity as measured by spreading coefficient was determined for nonionic surfactants (Petrascu and Baltac, *Acad. Rep. Populare Romine, Studii Cercetari Chim. 11*, 215). Nucleation and growth rate of strontium sulfate in several surfactant systems was measured (Oyama and Sato, *Sci. Rept. Fac. Lit. Sci., Hirosaki Univ. 10*, 53).

PERFORMANCE TESTS

Discussed were experimental methods for foam measurement, stability, adsorption, and surface tension. Foam inhibiting effects of alcohol upon sodium lauryl sulfate solutions were mentioned (Ruyssen, *Chem. Weekblad. 60*, 105). Dynamic and static methods for foam measurement were reviewed (Shansky, *Soap Chem. Specialties 40*(4), 57). Various features of the Ross-Miles foam test and apparatus were investigated (Gohlke, *Parfeum. Kosmetik 45*(3), 59). A dynamic foam test was devised using the Tergotometer, a sebaceous soil, the measurements being made by Polaroid pictures (Spangler, *JAOCS 41*, 300). Solubility, interfacial tension, and cmc values for surfactants in liquid aerosol propellants were measured (Kanig, *J. Soc. Cosmetic Chemists 15*, 549). Bottle washing detergents were evaluated by measuring removal of fatty, protein and soot soils in a stirring apparatus (Bradacs and Schetelig, *JAOCS 41*, 161). Dishwashing detergent effectiveness was measured by determining the resistance of two platinum electrodes coated with a soil, one part tallow and 2½ parts stearic acid, and immersing them in detergent solution at controlled temperatures (Oehler and Rinckleb, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963*, 202). Results said to be equivalent to whiteness measurement of soiled fabrics were obtained by continuous measurement of detergency bath turbidity (Schaurich, *Ibid, 1963*, 193). Degree of dispersion of oil and oil-pigments used to soil wool were used to compare soap, anionic, and nonionic detergents for wool scouring effectiveness (Roesch, *Fette, Seifen, Anstrichmittel 65*, 755). Various wool scouring detergents were characterized by their ability to wet lanolin soiled wool (Dobozy et al., *Kolorisztikai Ertesitoe 3*, 162). Methods for control of ethoxylated nonionic production were cloud point, sinking times, and detergency (Lehmann, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963*, 238). The details of a test to evaluate detergents for washability of painted metals are given. The soil used was an artificial one similar to occurring on car bodies (Arpino and De Rosa, *Riv. Ital. Sostanze Grasse 40*(2), 55). Performance tests of household detergents comprised sinking time, foam, detergency, and bleaching (Plass, *Ibid, 1963*, 211). The use of skin tests in soap evaluation was discussed (Greither, *Symp. Dermatol. Corpus Lectionum, Univ. Carolina, Prague, 1960*, 3, 199). A caking test for dried detergents was developed (Watanabe and Groves, *JAOCS 41*, 311). The penetrability of surfactants was measured by using paper strips of varying character (Unuma et al., *Noyaku Seisan Gijutsu 9*, 8).

BIODEGRADATION

ANIONICS. Proposed criteria for biodegradable detergents were compared with the existing West German law. A continuous test apparatus was devised to simulate a sewage plant using ABS (Barnhart and Eckenfelder, *J. Biotechnol. Bioeng. 5*, 247). External variables affecting adaptation and rate of degradation were discussed, such as surfactant concentration at constant bacterial count, count at constant surfactant concentration, river water storage period, influence of easily assimilated COD, temperature, agitation, and oxygen partial pressure of aerating gas (Fuhrmann et al., *Soap Chem. Specialties 40*(2), 51). Use of alpha-olefins and normal paraffins for ABS production were discussed (Hatch, *Hydrocarbon Process. Petrol Refiner 43*(3), 91). Closer fractionation of the alkylate side chain to C_{10-14} has resulted in attaining biodegradability. Various patented processes are discussed (Scott, *Ibid, 43*(3), 97). Straight chain alkylbenzenes are obtained from chlorinated paraffin waxes, dehydrohalogenated, aromaticized and sulfonated (Chemische Werke Huels A.-G. *Belg. 632,807*). A process for preparing easily biodegradable tetrapropylenebenzene is disclosed (Ruschenburg et al., *Ger. 1,166,185–6*). Biodegradable low foaming n-decylbenzene sulfonate is disclosed (Ploetz, *Belg. 633,530*). ABS of C_{10-18} linear form and isomers with the phenyl group at different carbon atoms along the chain were studied for biodegradability. Decrease in biodegradability as a result of molecular weight increase or of moving the phenyl group toward mid-chain was confirmed (Sweeney, *Soap Chem. Specialties 40*(3), 45). The function of structure of alkane sulfonates and alkylarenesulfonate, biphenyl rings, CON methyl groups and symmetrical branching of the alkyls was tested using a closed bottle method and a culture of Escherichia Coli, and the data discussed (Koelbel et al., *Tenside 1*(1), 7).

The performance of linear alkylate sulfonate (LAS) formulations was determined (Stanberry et al., *Soap Chem. Specialties 40*(7), 43). In typical heavy duty formulations LAS was equal to or better than ABS (Foster and Fields, *Ibid., 40*(8), 49). Gas chromatography was used to follow the course of biodegradation of ABS to show the presence and nature of transient intermediates (Swisher, *J. Water Pollution Control Federation 35*, 1557). The biodegradation of n-hexadecyl sulfate, hexadecanesulfonate, and tetrapropylenebenzenesulfonate was followed by oxygen uptake and residual surfactant as a function of time, the rate of decomposition increasing in that order. Addition of ethylene oxide to n-hecadecanol reduced biodegradability in proportion to increase in oxyethylene chain length (Ruschenburg, *Fette, Seifen, Anstrichmittel 65*, 810). Various alkylbenzenesulfonates were subjected to microbial biodegradation using pure cultures of various bacterial and mixed cultures from soil, river water, and activated sludge. Identification of intermediates indicated that beta-oxidation of LAS is one of the decomposition pathways (Huddleston and Allred, *Develop. Ind. Microbiol. 4*, 24). Fundamental information on test variables was developed to standardize the determination of degradation by the river die-away test (Fuhrmann et al., *Soap Chem. Specialties 40*(2), 51). The distribution of ABS and residues in water and waste of Maryland was intensively investigated (Renn, *Proc. Ann. Symp. Ind. Waste Control 4,* 22).

Activated sludge used in evaluating various anionic surfactants as to their ease of removal from waste waters (Lukinykh, *Vodosnabzh. i. Sanit. Tekhn. 1963*(9), 9). ABS in the Japanese Tama River was seasonally determined (Murakami et al., *Yukagaku 13,* 217). The effect of several anionics on biochemical processes of purification of waste waters showed more complete removal by air tank purification than by biofilters (Lukinykh et al., *Nauchn. Tr. Akad. Kommen. Khoz. 1963*(20), 124). The biodegradation of LAS was studied by a modified river die-away test, the shake culture flask using Pseudomonas and a lab activated sludge test. A field test was also performed (Renn et al., *J. Water Pollution Control Federation 36,* 864). The aerobic biological treatment of ABS was investigated (Meinck and Bringmann, *Schriftenreihe Ver. Wasser-Boden-Lufthyg. 1961*(19), 68). The intermediate products of biodegradation of LAS were studied using ultraviolet spectroscopy to identify the compounds (Krueger, *Fette, Seifen, Anstrichmittel 66,* 217). Factors affecting the degradation of the side chain of ABS in the river die-away test were discussed (Fuhrmann et al., *Chem. Specialties Mfrs. Assoc., Proc. Ann. Meeting 50,* 84). A method involving microdesulfonation and capillary gas chromatography was devised to quantitatively determine the relative rates of biodegradation of isomeric straight-chain diheptylbenzenesulfonates (Swisher, *Develop. Ind. Microbiol. 4,* 39). The river die-away test was combined with the methylene blue procedure to determine the degradation of ABS (Wayman and Robertson, *U.S. Geol. Survey, Profess. Papers* 475-C, 224). The removal of ABS by microorganisms in sewage systems is presumed to be by biodegradation. It is proposed that adsorption on sludge particles or soil is the mechanism for removal (Hartmann, *Biotechnol. Bioeng. 5,* 331). ABS alone at the concentrations found in finished water, is not the cause of taste and odor (Cohen, *J. Am. Water Works Assoc. 55,* 587). Experiments with live fish show that essentially all the isomers of ABS are truly degradable (Sherman, *Nature 201,* 704).

Radiotagged ABS passed through a simulated septic tank and drain field showed up to 95% degradation with straight chains and 35% with branched (Straus, *Science 142,* 244). Filtration of sewage plant treatment effluents was tested with saturated flow through packed soil columns of various kinds. Common soil types removed insignificant amounts of ABS or dissolved solids. Green sand, muck, and basalt soil removed 60 to 94% of 3- to 5-ppm ABS but increased the solids content to 1800% (Page and Wagman, *Am. Chem. Soc., Div. Water Waste Chem.,* Preprints 1963(Jan), 4). ABS is removed by filtration through granular activated carbon. Thermal reactivation of the carbon is described (Joyce and Sukenik, *Ibid,* 1962(Sept), 20). Diatomite filtration is used to remove ABS from laundry effluent and it is reduced to less than 3 ppm from an initial 50 to 80 ppm (Davis et al., *Ibid,* 1963 (Jan), 59). Since ABS is found in some waters, its effect upon plant growth was investigated. No consistently adverse effects were found on plants grown in greenhouse soils even though relatively high concentrations were used (Bing, *N.Y. State Flower Growers Bull. 226,* 4). The effect of ABS on two species of diatoms, a snail, and sunfish was studied (Cairns et al., *Ind. Water Waste 9,* 22). The problems encountered in ABS removal from wastes are reviewed (Bueltman, *Proc. Maryland-Delaware Water Pollution Control Assoc. 36,* 62). A process is described for producing microbiologically stable alkylarenesulfonates. These are useful where solutions containing them are kept in use for long periods of time (Allred and Huddleston, *U.S. 3,138,543*).

NONIONIC. The limiting amount of alkylphenol ethoxylates in reservoir water affecting the organoleptic properties of water, is 0.4 to 1.5 mg per liter (Goeva, *Sanit. Okhrana Vodoemov ot Zagryazneniya Prom. Stochmymi Vodanic 1962,* 233). Dodecyl alcohol ethoxylates of lower ethoxylate content degrade faster than those with 20 or 30 groups. No change in rate with difference only in the alkyl grouping was found. Degradation is slower with secondary dodecyl ethoxylates as the ethoxy group is moved toward the chain centre. Presence of secondary alkyl groups on alkylphenols results in slower degradation (Blankenship and Piccolini, *Soap Chem. Specialties 39*(12), 75). Linear anionic and nonionic ethoxylated surfactants were tested by river die-away, activated sludge, Warburg respirometer, and anaerobic die-away methods (Vath, *Chem. Specialties Mfrs. Assoc., Proc. Ann. Meeting 50,* 75). Linear primary and secondary alcohol ethoxy and alkylphenol ethoxylated surfactants were evaluated. The methylene blue and cobalt thiocyanate methods were used to determine completeness of biodegradation (Vath, *Soap Chem. Specialties 40*(2), 58). All surfactants as derivatives of secondary alcohols, particularly nonionics were claimed to be biodegradable (Myerly et al., *Ibid., 40*(5), 78). Degradation of ethoxylated tallow sucroglyceride was followed by Warburg respirometer and registering microbiophotometer, determination of fatty acid residues chromatographically, and polyoxyethylene residues spectrophotometrically. Rate of biodegradation is discussed (Brebion et al., *Rev. Franc. Corps. Gras 11,* 191). Sucrose monoricinoleate is claimed as a biodegradable surfactant (Zimmer, *Belg. 628,850*).

MISCELLANEOUS BIODEGRADATION. It is predicted that sewage treatment problems will continue with soft detergents, and are two to four times as toxic to fish. Other plant operating conditions are discussed (Kiess, *Wasserfach 104,* 1443). The raw material picture for the United States for making biodegradable detergents is surveyed (Anon, *Chem. Eng. News 41*(44), 138). Current thinking on the mechanism of biodegradation is discussed (Raphael, *Mfg. Chemist 35,* 59). Sugar esters are discussed as replacements for ABS (Simonis, *Industrie ab Wasser 1963,* 31). The search for biodegradable detergents is reviewed (Lomas, *Purdue Univ., Eng. Bull., Ext. Ser.* No. *115,* 309), as was the general subject (Dicker, *Rept. Progr. Appl. Chem. 48,* 334). The relation of biodegradation reactions and detergent structure in river water was studied (Swisher, *Proc. Ann. Aump. Ind. Waste Control 4,* 60). The river water die-away test was used to evaluate thirty three anionic and six nonionic surfactants (Weil and Stirton, *JAOCS 41,* 355). The surfactant concentration in water in the upper Elbe River was determined at towns along the river banks, and the time for degradation evaluated (Vauck and Junghans, *Deut. Textiltech. 13,* 485). An intensive investigation was made of residues of ABS in Maryland waters and wastes (Renn, *Proc. Ann. Symp. Ind. Waste Control 4,* 22).

The high concentrations of surfactants in textile effluents was studied in laboratory models of aeration tanks (Yakovlev et al., *Vodosnabzh. i Sanit. Tekhn. 1963*(9), 12). The decomposition of hard and soft surfactants was studied by activated sludge, trickling filters, and oxidation ditches, the effectiveness of treatments being discussed. It is noted that absorption of surfactants may lead to erroneously high decomposition figures (Spohn, *Tenside 1*(1), 18). Pure bacterial cultures were used in determining biodegradable characteristics of several anionic and nonionic surfactants. An enzymatic method of detection of nonionic surfactants depends upon attempts to isolate bacteria capable of utilizing longer polymers (Payne, *Biotechnol. Bioeng. 5,* 355).

Described were the various analytical technics used to measure the various aspects of biodegradability with an interpretation of the results of each (Allred et al., *JAOCS 41,* 13). An accelerated biodegradability test was devised using natural river water fortified with additional organisms isolated from sewage effluent (Hitzman, *Ibid., 41,* 593). Batch and continuous methods of surfactant removal from sewage effluent by foam concentration were tested, reducing ABS content from 2 to 3.2 to 0.3 to 0.5 ppm (Rubin and Everett, *Ind. Eng. Chem. 55*(10), 48). Foam separation of sodium dodecylsulfate and ABS permitted an equilibrium expression relating the instantaneous concentration in foam to that in the residual liquid (Obermann et al., *Am. Chem. Soc., Div. Water Waste Chem., Preprints 1963* (Jan), 28). Foam fractionation was used as a means for separating surfactants, skimming off the foam, then collapsing it. Attempts were made to develop a mathematical model for predicting the rate of disappearance of ABS from waste water (Eldib, *Ibid., 1963*(Jan), 46).

Adsorption conditions were established for the removal of sodium dibutylnaphthalenesulfonate and kerylbenzenesulfonate from Vistula water, using activated carbon for adsorption (Kotulski and Sztafrowski, *Gas. Woda Tech. Sanit. 36*(1), 27). Test results using activated carbon for ABS removal from both distilled and trickling filter sewage treatment plant water were obtained (Battey, *Am. Chem. Soc., Div. Water Waste Chem., Preprints 1963*(Jan), 54). Removal of sodium DDBS from laundry effluent was attempted using ferric chloride as a coagulant as compared with aluminum sulfate, the former proving more effective, but calcium chloride removed more surfactant and phosphates (Kresta and Koubik, *Chem. Prumysl 14,* 287). Biodegradation is inactive in sand and clay which act as physical adsorbants for surfactants (Lenhard and Plooy, *Hydrobiologia 22*(3–4), 317). Bi- and trivalent ions were more effective than monovalent ions, the trivalent ones hydrolyzing to form absorptive colloids (Saito et al., *Kogyo Kagaku Zasshi 67,* 464). The effect of aluminum, ferric, magnesium, and calcium ions in removing phosphates from solution were compared, the calcium ion giving poorest results in sewage (Henriksen, *Schwiez. Z. Hydrol. 25,* 380). A one-stage precipitation process using precipitation by calcium chloride removed both surfactants and phosphates simultaneously from laundry waste water (Koubik and Pelz, *Czech. 111,131*). A part of biologically undecomposable surfactant used in the study (ABS) is removed by sorption on the excess slurry, this being quite a different effect from biological decomposition (Pitter, *Vodni Hospodarstvi 13,* 250). Methods for foam dissipation include mechanical removal from effluents prior to discharge into the river and use of a rapidly degraded surfactant (Bolle et al., *Chim. Ind.* (Paris), *90,* 491). Lime was used to remove ABS and alkylnaphthalenesulfonate from waste water used in synthetic rubber production (Kotulski and Sztafrowski, *Gas. Woda Tech. Sanit. 36,* 192). Dialkylnaphthalenesulfonate is removed from waste water by multistage extraction with C_{5-8} alcohols (Strukov, *U.S.S.R. 163,117*).

The following symposium on biodegradable detergents was presented. Evaluation of detergents by using activated sludge (Huddleston and Allred, *JAOCS 41,* 732); A review of detergent and water quality standards (Weinberger and Powers, *Ibid.,* 736); Measurement and biodegradability (Weaver and Coughlin, *Ibid.,* 738); Performance and properties of nonionic surfactants from linear secondary alcohols (McFarland and Kinkel, *Ibid.,* 742); Fish bioassays of linear alkylate sulfonates (LAS) and intermediate biodegradation products (Swisher et al., *Ibid.,* 746); The determination of poly(oxyethylene)nonionic surfactants in water at the parts per million level (Crabb and Persinger, *Ibid.,* 752).

TOXICOLOGY

The toxicology of ABS in mice and rats was elucidated. The effect of ABS dusts on the lungs of rabbits was demonstrated. The amounts of ABS dust normally inhaled by plant workers was determined by absorbing the dust on gauze respirators. Extensive examination of plant vs. office workers showed that the incidence of skin diseases in those more fully exposed was perhaps greater, the main effect being irritation to the mucous membranes and skin, the latter being acute contact dermatitis (Sakabe et al., *Ind. Health* (Kawasaki, Japan), *8*(8), 21). The effects of application to the skin of esters of sugar, sugar glycerides, and derivatives were recorded (Nobile et al., *Parfums, Cosmet., Savons 6,* 495). The functional characteristics of monoesters of sulfosuccinic acid for their skin irritant effects were described (Hoffmann, *Fette, Seifen, Anstrichmittel 65,* 748). The eye test for rabbits was used to show that cations such as sodium and potassium, added to fatty acid soaps had no additional effect, and that C_{12} soaps had maximum irritating effect (Takei and Kimura, *Seikagaku 32,* 525). The Draize test and the F.D.A. test for potential irritancy of ten commercial shampoos to the rabbit eye mucosa were compared, the new test showing up irritation not detected by the Draize test (Gaunt and Harper, *J. Soc. Cosmetic Chemists 15,* 209). Electropotentiometric titration was used as a potential measure of skin-irritating effect (Piper, *Symp. Dermatol., Corpus Lectionum, Univ. Carolina, Prague, 1960, 3,* 194).

The effect upon rats of DDBS added to their drinking water produced no detrimental results (Bornmann and Loeser, *Fette, Seifen, Anstrichmittel 65,* 814). Examples of new dermatophilic shampoos were given based upon mixtures of amphoteric surfactants with fatty alcohol ether sulfates (Felletschin, *J. Soc. Cosmetic Chemists 15,* 245). The effect of ABS was measured at sublethal concentrations on two species of sunfish (Cairns and Scheier, *Purdue Univ. Eng. Bull., Ext. Ser.* No. *112,* 14). The structure of ABS and their toxic influence on fish was determined with special reference to alkyl chain length and position. The relative toxicities depending upon structure is given (Hirsch, *Vom Wasser 30,* 249). The reversible interaction of sodium dodecyl sulfate with bacterial chromatophores was investigated (Newton, *J. Biol. Chem. 239,* 1585). The addition of a nonionic detergent to a diet containing 10% added fat aided fat digestion but had no effect on protein or carbohydrate digestibility. Fat absorption was impaired slightly by an anionic detergent, but was seriously impaired by a cationic surfactant (Bolton, *J. Agr. Sci. 57*(1), 83). The physiological properties of ABS are discussed (Kitano, *Kagaku* (Kyoto) *17,* 229).

MISCELLANEOUS USES

The theoretical and practical approaches to industrial use of surfactants are collected and discussed (Schwarz and Reid, *Ind. Eng. Chem. 56*(9), 26). Partially acetylated mono- and diglycerides were used to produce cosmetic creams with improved consistency (Pokorny' et al., *J. Inst. Chem. Tech. Prague 7–1,* 167). Sucrose esters and sucrose glycerides are recommended for shampoos, tooth paste, shaving creams and other cosmetic uses (Colson, *Riv. Ital. Sostanze Grasse 39,* 472). Improved softness and skin absorption for cosmetic creams are claimed for sucroglycerides (Ledoga S.p.A. *Brit. 943,174*). Cationic surfactants as bacteriologically active compounds are recommended for a number of cosmetic products (Lambert, *Kosmetik-Parfum-Drogen Rundschau 10*(9/10), 141). Permanent wave compositions are improved through added surfactants (Oertel et al., *Ger. 1,157,347*).

A specialty surfactant consisting of polyoxyalkylated tertiary carbinamines is demonstrated as effective in wool processing (Taylor and Benischek, *Am. Dyestuff Reptr. 53*(6), 56). Quaternary ammonium salts are claimed as stabilizers for sodium sulfide depilatories (Higginbotham, *Brit. 941,295*). Cationic surfactants for use in glass finishing were reviewed (Meier, *Abhandl. Deut. Akad. Wiss. Berlin, Kl. Chem., Geol. Biol. 1963*(2), 101). Acetate fibers were dyed with disperse dyes more effectively when a proper type of surfactant is used in the dye bath. Recommendations are given (Sadov et al., *Izv. Vysshikh. Uchebn. Zavedeneii, Tekhnol. Legkoi Prom. 1962*(1), 56).

Evaporation retardation research on small reservoirs for the period 1958 to 1963 was reviewed (Meinke and Waldrip, *Texas Water Comm., Bull.* No. *6401*). The effect of single layers of higher alcohols from petroleum source in reducing the evaporation was investigated, determining the effect of chain length, the protective action being determined by the primary alcohol content (Trapeznikov and Olgarev, *Sb. Prikl. Khim. 37,* 1817). The leaching of chalcopyrite using a bacterial inoculate was increased by added nonionic surfactant (Duncan et al., *J. Appl. Microbiol. 12,* 122). The effect of added anionic, cationic, and nonionic surfactants on the physical character of lead chromate showed that anionic and nonionic surfactants inhibit crystal growth, improving dispersibility (Ermilov and Fedorov, *Lakodrasochnye Materialy i ilch Primenenie 1,* 25).

Sucrose esters and fatty acid esters are recommended for use in the food industry (Manning, *Tr. Vses. Nauchn.-Issled. Inst. Zhirov 1961*(22), 110). A mixture of spent calcium chloride, spindle oil, and emulsifier was used to prevent dusting of streets (Maczynski and Komarek, *Gas. Woda Tech. Sanit. 36,* 314). Laundry sour or detergents are tinted with dyes containing anionic or nonionic surfactants (Millsaps and Staubly, *U.S. 3,123,565*). Nonionic surfactants are used in bactericidal dusts as dispersants (Taniguchi and Sugii, *Japan. 10,419*('62). Wetting agents for suspending Teflon contain an anionic surfactant and a fluoroalcohol (Zisman and Bernett, *U.S. 3,133,886*). Antistatic agents for polyvinyl chloride polymers are cationic surfactants (Yamamoto et al., *Kogyo Kagaku Zasshi 66,* 1740). A variety of applications are reviewed for cationic surfactant amines and their derivatives (Olsson, *Finska Kemistsamfundets Medd. 72,* 185).

GENERAL

The chemical composition, uses, and hygienic application of surfactants are reviewed (Ilany-Feigenbaum, *Mada 8,* 28). An address was given concerning industrial developments in the detergent field (Stupel, *Chem. Ind.* (London), *1964*(12), 470). Detergents were reviewed (Wagg, *Rept. Progr. Appl. Chem. 47* 196). A review is given from the latin ''sapo'' to modern soap (Galleymore, *Soap Chem. Specialties 39*(12), 83). The development of surfactants is reviewed (Chwala, *Tenside 1*(2), 41). Surface-active substances were reviewed (Black, *Recent Progr. Surface Sci. 1,* 248). Variations in the production of synthetic detergents is given (Pizzoli, *Quaderni. Merceol. 1*(1), 397). All types of surfactants are briefly reviewed (Kling, *Parfuem. Kosmetik 45*(1), 1). An extensive review was made of metal-containing surfactants (Suzuki, *Yukagaku 13,* 399). A new monthly journal, *Tenside,* is published in Germany.

An American Oil Chemists' Society short course contained the following presentations. Review of several available continuous saponification processes, (Schulerud, *JAOCS 40,* 609); Manufacture of soap from fatty acids (Herrick and Jungermann, *Ibid.,* 615); Continuous sulfonation techniques (Silvis and Ballestra, *Ibid.,* 618); Tableting of detergents (Mallee, *Ibid.,* 621); Phosphate builders for detergents (Netherton et al., *Ibid.,* 624); Recent advances in fatty amine oxides. Chemistry and preparation (Lake and Hoh, *Ibid.,* 628); Alpha-olefins in the surfactant industry (Liddicoet, *Ibid.,* 631); Use evaluation of alcohol derivatives in detergent formulations (Matson, *Ibid.,* 636); Recent advances in fatty amine oxides. Formulation and use (Matson, *Ibid.,* 640); Anionic phosphate surfactants (Cooper, *Ibid.,* 642); The nation's water pollution problem—detergents' role in it (Cohn, *Ibid.*, 645); The chemistry of surfactant biodegradation (Swisher, *Ibid.*, 648); Effects of detergents on surface and ground water problems (Kline, *Ibid.*, 656); Foreign requirements and developments in biodegradability (Houston, *Ibid.*, 659); New physical evaluation techniques (Ginn, *Ibid.*, 629); Eoil redeposition (Trost, *Ibid.*, 669); Correlation of detergency with physicochemical factors (Mankowich, *Ibid.*, 674); Physical chemistry of nonionic detergents (Schick, *Ibid.*, 680); Recent advances in the analysis of surface-active agents by noninstrumental methods (Rosen, *Ibid.*, 687); Principles and utility of nuclear magnetic resonance in structure determination of surfactant chemicals (Crutchfield and Irani, *Ibid.*, 691); Fluorescent agents for detergents (Zussman, *Ibid.*, 695).

The Annual Review of Literature will be continued in the August issue of JAOCS.

Official Referee Chemists
1965–1966

Certificates reading on cottonseed, oil cake and meal, protein concentrates, cottonseed oil, soybean oil, tallow and grease

E. R. Hahn and J. B. Scoggins, Hahn Laboratories, Columbia, S.C.
G. Henry, Law & Company, Atlanta, Ga.
R. M. Gilpin, R. C. Miller and F. C. Woekel, Geo. W. Gooch Laboratories, Ltd., Los Angeles, Calif.
L. H. Hodges, Barrow-Agee Laboratories, Inc., Memphis, Tenn.
L. S. Hunter and R. C. Pope, Pope Testing Laboratories, Dallas, Texas.
F. R. Robertson and M. M. Wooden, Houston Laboratories, Houston, Tex.

Certificates reading on oil cake and meal, protein concentrates, cottonseed oil, soybean oil, tallow and grease

J. J. Ganucheau and P. C. Thionville, Thionville Laboratories, Inc., New Orleans, La.
C. A. Lathrap, Curtis and Tompkins, Ltd., San Francisco, Calif.

Certificates reading on oil cake and meal, protein concentrates, soybean oil, tallow and grease

W. G. Wadlington, Wadlington's Referee and Testing Laboratories, Chicago, Ill.

Certificates reading on oil cake and meal, protein concentrates, tallow and grease

H. M. Espoy, Terminal Testing Laboratories, Inc., Los Angeles, Calif.
D. S. Brake, Walter B. Sizer, General Testing Laboratory, Ltd., Vancouver 1, B.S., Canada.
F. P. Owens and J. M. Owens, Laucks Testing Laboratories, Inc., Seattle, Wash.

Certificates reading on cottonseed oil, soybean oil, tallow and grease

C. V. Bacon, Chas. V. Bacon Laboratories, Inc., New York, N.Y.

Certificates reading on tallow and grease

M. A. Rust, Industrial Laboratories Company, Inc., Denver, Colo.
T. H. Williams and C. J. Ambacher, Northwest Laboratories, Seattle, Wash.

Certificates reading on cottonseed, oil cake and meal, protein concentrates, cottonseed oil, soybean oil

P. D. Cretien and R. M. Fox, Texas Testing Laboratories, Inc., Dallas, Texas.
G. G. Dickinson, Dickinson Laboratories, El Paso Texas.
J. H. Hamilton and C. R. Norris, Barrow-Agee Laboratories, Inc., Shreveport, La.
J. R. Mays, Jr., B. C. White, Jr., C. E. Worthington, Barrow-Agee Laboratories, Inc., Memphis, Tenn.
C. L. Manning, G. W. McMath, Fort Worth-Southwestern Laboratories, Fort Worth, Texas.
B. O. Pattison, Pattison's Laboratories, Harlingen, Texas.
P. L. Phillips, Barrow-Agee Laboratories of Miss., Inc., Jackson, Miss.
J. R. Southwell, Southwell Laboratories, Oklahoma City, Okla.
F. G. Schmid, Texas Testing Laboratories, Inc., San Antonio, Texas.
E. H. Tenent, Jr. and E. H. Tenent, Sr., Woodson-Tenent Laboratories, Memphis, Tenn.
M. D. Tilson, Texas Testing Laboratories, Inc., Lubbock, Texas.
P. C. Whittier, Law & Company, Montgomery, Ala.

Certificates reading on cottonseed, oil cake and meal, protein concentrates, cottonseed oil

W. A. Bridgers, Sr., Southern Testing & Research Laboratories, Wilson, N.C.
C. E. McLean, Sr., and C. E. McLean, Jr., Arizona Testing Laboratories, Phoenix, Ariz.
D. A. Bradham, Jr., Barrow-Agee Laboratories, of Miss., Inc., Greenville, Miss.
A. H. Grimes, Barrow-Agee Laboratories, Inc., Decatur, Ala.
Luis Mestas, Coast Laboratories, Fresno, Calif.
J. C. Lloyd, Alabama Testing Laboratories, Birmingham, Ala.
Mrs. Inez Hazeltine and R. H. Acock, Acock Laboratories, Austin, Texas.
E. S. Prevost, Law & Company, Wilmington, N.C.

Certificates reading on oil cake and meal, protein concentrates, cottonseed oil, soybean oil

J. G. Bowling, Woodson-Tenent Laboratories, Des Moines, Iowa.
J. G. Lipps, Jr., Pan American Laboratories, Brownsville, Texas.
A. C. McConnell, Woodson-Tenent Laboratories, North Little Rock, Ark.
W. D. Simpson, Woodson-Tenent Laboratories, Wilson, Ark.

Certificates reading on oil cake and meal, protein concentrates

H. M. Bulbrook, Industrial Laboratories, Fort Worth, Texas.
W. A. Fix, Plains Laboratory, Lubbock, Texas.
H. L. Hutton, Woodson-Tenent Laboratories, Clarksdale, Miss.
H. J. Schulze, New Jersey Feed Laboratories, Trenton, N.J.

Certificates reading on cottonseed oil, soybean oil

E. C. Brankley, Chas. V. Bacon Laboratories, Inc., Galena Park, Texas.

Certificates reading on soybean oil

J. P. Henry, Iowa Testing Laboratories, Eagle Grove, Iowa.

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• *Obituary*

J. E. Hanaché (1953), Old Westbury, N. Y., died Jan. 6, 1965.