The Australian Soap and Detergent Industry

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ABSTRACT

The size, population distribution, and climatic variations of Australia are discussed. The standard of living is high; politically Australia is a federation of states; its manufacturing work force is highly unionized. The growth in the industry in the past 16 years is quantified, and the production of its raw materials and intermediates described, covering the appropriate technology. Product types are related to lifestyle and laundering habits and are described in that context. Marketing methods, advertising, and the industry association are briefly mentioned.

Australia is an island nation occupying a whole continent. A Pacific Ocean centered map of the world illustrates the distance of Australia from Europe and North America. The distance from Sydney and Melbourne to London is 17,000 km, to New York 16,000 km, to San Francisco 12,000 km, and to Tokyo 7,900 km. Sidney to Perth, east-west across the continent is 3,500 km, ten times the distance from London to Paris, and Adelaide to Darwin 2,700 km from south to north. Australia occupies 7.7 million square km, compared with Europe (excluding the U.S.S.R.) of 4.9 million square km and the mainland U.S. with 7.9 million square km.

The major difference, however, lies in the number of people. In Australia the total population approaches 14 million, but it is concentrated along the southeastern seacoast of the country. Nearly 63% of the population lives in New South Wales and Victoria, which between them have only 13½% of the total area. Most inhabitants of these two states live in the two state capital cities–Sydney with 3 million and Melbourne with 2.6 million–representing between them 41% of Australia's total population. The reason for the low population density is that a very large proportion of Australia is either uninhabitable or can only support a very sparse population.

With 38% of the continent north of the Tropic of Capricorn, the climate varies from tropical in the north through subtropical to temperate. On the basis of their relative latitudes, Sydney can be compared with Naples, and Melbourne with Rome. Because of these wide climatic variations, Australian lifestyles vary from south to north. In the major areas of population, however, there is a considerable amount of uniformity. Individual home ownership is high and multi-story housing developments are the exception rather than the rule, even in the large cities.

Australia has a high standard of living, comparable with the U.S. and affluent European countries. This is demonstrated by the OECD comparisons published from time to time. In the March quarter of 1977 the average weekly earnings, covering both salary and wage earners, was A$200 per week; the average minimum wage rate (excluding overtime) for all industry was A$140 and for manufacturing industry A$134. At present, an Australian dollar is worth about $1.10 U.S. The standards of education are high; there are 14 universities, having many internationally known research schools. The Commonwealth Scientific and Industrial Research Organisation (CSIRO) is unique, and its scientific excellence is renowned throughout the world; there are also many well-equipped industrial research establishments in all fields of manufacturing.

Australia is a federation of six sovereign states formed in 1901 under a constitution that has undergone little change in three-quarters of a century. This constitution sets out the powers of the Federal Government and leaves all residual, not specifically allocated, powers to the individual states. This results in problems of nonuniformity of all sorts of regulations from state to state. For example, there still is no uniform traffic code in Australia. An example more specific to our industry lies in the fact that the National Health & Medical Research Council (NH & MRC) is a federal body which puts out recommendations on all matters relating to health. These may or may not be adopted by individual states. In the main, good reason tends to prevail and individual state health departments adopt NH & MRC recommendations. Nevertheless, in some areas in which industry products are used, health regulations vary from state to state to such an extent that they are mutually exclusive. This makes it difficult for such a product to be marketed nationally, as labeling requirements then differ from state to state.

The manufacturing labor force in Australia is highly unionized, and all industry suffers from labor unrest. Because the unions are "trade" unions not "industry" unions, demarcation disputes become serious problems. These arise from conflicts between two unions each claiming that their members should be doing a particular job. Australia has a system of arbitration and conciliation which is very sound in principle, but which suffers in practice from the fact that militant unions will express their displeasure with an unfavorable court decision by further industrial action.

What does the soap and detergent industry encompass? In Australia there are convenient, almost official, definitions which arose during the discussions between industry and government representatives concerning the voluntary change to biodegradable products in 1970-1971. A subcommittee of the NR & MRC defined a surface-active agent (or surfactant for short), as an organic material which has structurally asymmetrical molecules containing both hydrophilic or water-soluble groups and hydrophobic or oil-soluble hydrocarbon chains and is characterized by its ability to alter the surface or interfacial tension. The committee defined a detergent as a product containing surface-active agents, designed for cleaning and washing which has the property of removing and suspending soil. I propose, therefore, to use the word "detergent" for formulated products, and the word "surfactant" for the surface-active ingredients. In that definition, the chemical entity soap is, of course, a surfactant so the first, and still well-known detergent, was born in 1907 when "Persil," combining soap, silicate, and perborate, came on the market.

There has been a steady growth in the Australian soap and detergent industry with a pattern, not unlike that elsewhere in the world, where the soap as a surfactant in detergents has been substantially replaced by synthetic surfactants in virtually all product categories–except in

TABLE I

Australian Soap and Detergent Industry
Annual Production

Fiscal year	Soap based (1000 Tons)	Synthetic based (1000 Tons)	Synthetic total (%)
1961-62	96.1	54.2	36
1963-64	97.0	68.0	41
1965-66	86.8	84.1	49
1967-68	73.7	121.6	62
1969-70	67.3	147.0	69
1971-72	74.2	176.0	70
1973-74	71.7	198.4	74
1975-76	60.2	208.2	78
1976-77 (Estimate)	57.7	200.5	78

soap tablets for personal use. The manufacture of soap-based products has diminished from 96,000 tons per year in 1961-1962 to about 60,000 tons at present—48% of which is toilet soap.

On the other hand, synthetic surfactant-based products have increased from about 54,000 tons in 1961-1962 to 208,000 tons at present (Table I). The "cross-over" point, that is, when just over 50% of the total soaps and detergent production became based on synthetic surfactants for all product categories, occurred in Australia about 1966. For domestic detergents this happened in 1962, only 6 years after the first synthetic-based domestic laundry powder was marketed in Australia. This was about 10 years later than in the U.S., but earlier than in Europe, where, especially in the United Kingdom, there is still a significant proportion of soap-based detergents on the market. Currently, 94% of domestic detergents are synthetic surfactant based, compared to 78% for all product categories.

There has been a flattening out in the growth rate over the past few years, which reflects the reduction in the growth rate of Australia's population due to a falling birth rate and restriction of immigration, as well as the impact of the worldwide economic downturn on Australia.

The manufacturing industry in Australia suffers from the problem of a small, widely dispersed, though sophisticated, market. Although shipping costs provide some protection to local industry, a great deal of manufacturing industry is supported by tariff protection against imports. In the case of the chemical industry, of which the soap and detergent industry is a part, the level of tariff protection is relatively modest.

Raw materials for our industry are partly of local origin and partly imported. Tallow for soap making is produced extensively in Australia and is a major export commodity. Both beef and mutton tallow are produced, but the ratio varies according to the state of the rural industry and the extent of export of live sheep which tends to reduce the amount of mutton tallow available. Coconut oil, the other major raw material for soap manufacture, is almost entirely imported, although there is a small proportion which is expressed locally from imported copra. One of the major sources of coconut oil for Australia is Papua-New Guinea.

The major raw material for synthetic surfactants, alkylbenzene, is manufactured in Australia in one plant operated by Shell Chemical (Australia) Pty. Ltd., using imported olefin and a mix of local and imported benzene depending on availability. Because of the size of the market, already stressed, Shell has developed a single grade of alkylbenzene with acceptable performance of its sulfonated derivatives for use in both liquid and powder detergents. This, of course, differs from European or North American practice where different grades are used for the different applications.

By voluntary agreement between the industry and the Federal Government, all surfactants made and used in

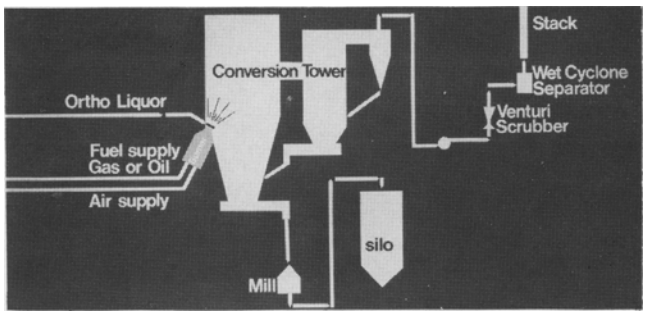

FIG. 1. Unique Australian method for polyphosphates production.

Australia have been biodegradable since the end of 1971. Biodegradability is measured by an Australian Standard Test Method developed by one of the technical committees of the Standards Association of Australia, broadly based on the procedure outlined by the U.K. Standing Technical Committee on Synthetic Detergents. Because of the relative lateness in changing to biodegradable surfactants, the Australian conversion involved anionic and nonionic surfactants simultaneously.

Nonionic ethylene oxide derivatives are manufactured in a single plant operated by ICI Australia Petrochemicals Limited, which makes a wide range of ethoxylates in order to meet the Australian market demands. Naturally this reduces their ability to take advantage of economies of scale, and the price of Australian ethoxylates is therefore higher not only per se but also relative to other types of surfactants. Alkanolamides, for example, because of relatively cheap coconut oil, are only slightly more expensive than ethoxylates. Consequently, ethoxylates have not made the penetration into Australian product formulations that they have made in other parts of the world.

Fatty alcohols are not made in Australia because the total consumption is well below the volume required for an economically viable plant for making either natural or synthetic fatty alcohols.

Sodium tripolyphosphate is manufactured locally by Albright & Wilson (Australia) Limited using a unique process, developed in Australia, appropriate for the magnitude of production (Fig. 1). Instead of drying the sodium phosphate solution (with the correct sodium to phosphorus ratio) and then calcining it in a separate operation to convert it to the polyphosphate, the two operations are carried out in a single step by spraying the orthophosphate liquor into the flame of a high intensity burner into a tower, not unlike a spray drier. Drying and conversion take place virtually simultaneously.

There is no indigenous sulfur, though some is recovered from the refining of imported (Middle East) crudes. Sulfuric acid and caustic soda are made locally. The latter is expensive compared to the rest of the world. Soda ash is also produced locally, but sodium sulfate is usually imported as by-product material and is relatively cheap.

The two major manufacturers of domestic detergents in Australia, Lever & Kitchen (a subsidiary of Unilever) and Colgate-Palmolive, operate their own SO_3 sulfonation plants for captive use. There are six sulfonators who use sulfuric acid or oleum for sulfonation of alkylbenzene. Albright & Wilson (Australia) Limited operate both an SO_3 sulfonation and sulfation plant, and a sulfuric acid sulfonation plant, producing a complete range of surfactants as detergent and toiletries intermediates.

Because liquid SO_3 is not available in Australia, nor economic to make and transport, all three SO_3 sulfonation plants in Australia start with elemental sulfur and use converter gas as the sulfation/sulfonation medium. Sulfonation technology otherwise is similar to that used elsewhere

TABLE II

Annual Consumption
Toilet Soap

	kg/Capita
Australia	1.57
U.S.	1.25
U.K.	1.06
France	0.69
Germany	0.69

TABLE III

Annual Consumption

	Fabric washing products	Hand dishwashing liquids
	kg/Capita	
Australia	5.89	5.43
U.S.	8.48	2.71
U.K.	5.79	2.44
France	7.17	2.28
Germany	9.26	1.48

in the world. Because air pollution controls are stringent, extensive effluent gas treatment is required, increasing both capital and operating costs.

On the soap making side, the five manufacturers who carry out saponification use batch processes. Equipment costs are such that conversion to continuous soap making plants is still some years away. On the other hand, in the case of toilet soap finishing, modern continuous machinery is used, and there are a number of additional manufacturers who purchase flake soap stock for the production of soap tablets.

To operate plants with a reasonable economy of scale, the major soapers manufacture their products in one location only (Sydney) and distribute right across the continent. Therefore, distribution costs are disproportionately high in Australia. In most of the state capital cities there are regional manufacturers whose production tends to be mainly of liquid detergents and toiletries, although there has been some growth in the production of domestic laundry powders made by processes not involving spray drying.

Looking at aspects of Australian lifestyle directly affecting the products of the soap and detergent industry, we find that Australians tend to shower daily and that taking a bath is unusual. In fact, many modern homes do not even possess a conventional bath tub. Because of daily showering habits, toilet soap production in Australia has remained high, and annual consumption is the highest per capita in the world (Table II). Although there are some synthetic surfactant-based shower gels on the Australian market, their share is small. On the other hand, hair shampoos have a larger market; as with daily showering, many people wash their hair frequently. Nearly 100% of shampoos are synthetic surfactant based, and hair conditioning products are a growing market. Formulations are, on the whole, similar to those used in the U.S. and Europe, but adapted to use the readily available, locally manufactured intermediates.

Domestic laundry habits are based on a high penetration of washing machines, 85% of homes in Australia have such an appliance. Tumble driers, though only becoming popular in recent years, are found in 20% of the homes. They tend to be used only for a comparatively small proportion of loads washed, being mainly an insurance against wet weather.

The majority of Australian domestic washing machines are top-loading automatic machines, similar to those predominating in the U.S. Most nonautomatic washing machines are twin-tubs with impeller agitation. Heating the water within the washing machines is rare and the so-called hot water used comes in the main from domestic water heating units, which provide water at temperatures between 50 and 60 C. Due to the warm average daily temperature in the northern states, cold water washing is gaining increasing acceptance so that products specially advertised for this use are marketed.

Although Australian domestic washing machines and habits are similar to those in the U.S., there are important differences. Pre-soaking is widely used in Australia, but bleaching is not. Only two of the major brands of domestic laundry powders contain a significant level of sodium perborate, while liquid hypochlorite bleaching is not widely used as Australian washing machines are not normally fitted with bleach dispensing devices.

Water hardness by world standards is relatively low. Seventy-four percent of the Australian population use soft water with a hardness of less than 60 ppm (as calcium carbonate); 8% of the population use moderately hard water in the 60-120 ppm range; and 14% have to use hard water (120-180 ppm) regularly. Some problems are encountered in cities such as Brisbane and Adelaide where the water hardness fluctuates during the year according to the amount of rainfall. This is in particular contrast to Europe where only a small percentage of the population has available to it unsoftened water of less than 60 ppm. Accordingly, Australian synthetic surfactant-based domestic laundry powders, on average, contain:

Surfactants	10-20%
Sodium tripolyphosphate	20-30%
Sodium silicate	7-10%
Sodium carbonate	10-15%
Sodium carboxymethylcellulose	0.3-1%
Optical brighteners	0.3-1%
Perfume	0.1-0.2%
Water	8-12%
Sodium sulfate	to 100

Of course, not all domestic laundry powders contain all these ingredients. Surfactants are predominantly anionic, mostly sodium alkylbenzene sulfonates with only small amounts of fatty alcohol ethoxylates, alkanolamides, and soap used.

The level of tripolyphosphate is low by world standards (other than in countries where restrictions exist) and is really only adequate to deal with the low hardness of the Australian water supply and the contribution of hardness from the soil present on fabrics being washed. Because the majority of the Australian population lives on the coast and discharges its waste (more or less treated) to the sea, there is no eutrophication problem in Australia. The possibility of problems in one or two of the larger inland cities exists, but can be eliminated by appropriate tertiary sewage treatment. In any case, the widespread use of phosphatic fertilizers in Australian agriculture means that the phosphorus content of inland waters only has a very small component from detergent phosphates.

Union pressure in the workforce in New South Wales has prevented the use of enzymes in major washing powders since 1971. As already mentioned, sodium perborate is not greatly used; when used, it is at 15-20%.

Liquid domestic laundry detergents have only recently appeared. It is too early to judge consumer acceptance. If U.S. trends are followed, as they so often are in Australia, then these products will command a significant market share in the future.

In contrast to domestic clothes washing machines, dishwashing machines have made a relatively small impact as yet. Although the sales growth rate is rising rapidly, dishwashing machines are still generally regarded as a relative luxury. Consequently, major dishwashing machine powders are imported fully packed, though there is a growing local production by regional manufacturers.

Because of the small penetration of domestic dishwashing machines, there is a large market for hand dishwashing liquids, and this is a widely dispersed market with manufacturers of all sizes involved. While the annual consumption of fabric washing products is not particularly high in Australia, that for hand dishwashing, like toilet soaps, is the highest in the world (Table III).

Australian liquid dishwashing detergent formulations, like the powders, are predominantly based on alkylbenzene sulfonates, with alkanolamides, ethoxylates, and, more recently, ethoxysulfates as part of the surfactant system. Lotionized liquids have been in vogue, but it is my impression that clear products are now more popular again.

A peculiarity of the Australian market has been the success of low active liquid detergent products for hand dishwashing application. Products with as little as 4% active ingredient have been on the market, although actives are now rising as the relative cost of packaging and distribution makes these very dilute products uneconomic. In Australian terms, medium active products are in the 10 to 12% range with the better class products having around 16 to 18% active ingredient, and a few premium products around 25%.

As a result of this pattern, a product type has been developed in Australia which, at this stage, appears to be unique. This is the home dilutable concentrate which is marketed either in disposable pillow packs or small bottles for dilution by the housewife to a concentration which suits her particular needs. These concentrates have succeeded in replacing a substantial proportion of the low active dishwashing liquids and have gained significant consumer acceptance.

Marketing methods, in general, are no different in Australia than those used elsewhere in the world, although there is no brand recommendation by washing machine manufacturers. Private label or "own brand" detergents are currently playing only a small part in the Australian market. Proportionately there are far more light duty liquids in this category than laundry powders. Advertising has recently come under increasing criticism, especially by consumer activists, and discussions concerning the content of advertising have played a large part in hearings before the Industries Assistance Commission and our Prices Justification Tribunal.

Industrial detergents represent around 30% of the soap and detergent industry but cover a large variety of products, usually formulated for a specific cleaning task.

The Australian Chemical Specialties Manufacturers Association (ACSMA) is the industry association, whose members account for over 80% of sales of industry products. Formed just over 2 years ago by the amalgamation of the Australian Surfactants Association and the Association of Sanitation Chemical Manufacturers of Australia, it is an associate member of the AIS and corresponds regularly with similar associations in the U.S. and the U.K. One of the most important roles of ACSMA is to keep its members advised of proposed changes of legislation, both federal and state. Members of the ACSMA board of directors regularly hold discussions with relevant government departments at ministerial level, while technical personnel of member companies sit on committees of the Standards Association of Australia and negotiate with state health department officials about regulations.