

# Cationic Fatty Acid Derivatives Aid Retention of Starch and Pigment Color in Cellulosic Pulp

## Abstract

Cellulosic pulp in water suspension treated with 0.06% selected cationic fatty acid derivatives at pH 4.5 retained up to 99% of gelatinized corn starch and a pigment color.

Inorganic acid and acetic salts of amines and quaternary ammonium compounds derived from fatty acids attach themselves to polysaccharides by complex formation or by physical adsorption (1-3). Several of these compounds have been patented for use as retention aids for starch (4-6) and other anionic additives (4,6,7) in paper manufacture. In a screening program on retention agents for starch in cellulosic pulp we evaluated a number of fatty acid-derived cationic products including some of those stated to be of value for this purpose. We compared the capacities of the most effective of these compounds for retaining gelatinized corn starch and also a pigment color in bleached softwood sulfate pulp at pH 4.5.

The compounds were the quaternary ammonium salts: (A) carbethoxymethyl dimethyloctadecyl ammonium chloride synthesized from Armeen DM18D (Armour Industrial Chemical Company, Chicago) (8); (B) the amide and (C) the hydrazide, both prepared from the carbethoxy compound (6,8); (D) hexadecyltrimethylammonium chloride (Arquad 16-50, Armour); and (E) an amine salt, tallow-1,3-propylene diamine (Duomeen T, Armour) diacetate (4,5).

Stock dispersions of corn starch and cationic agent used to evaluate starch and pigment retention were prepared by heating mixtures of 1.5% starch with 0.015% and with 0.03% of cationic agents in water at 95 C for 30 min. Portions of the dispersions were added to 1.2% cellulosic pulp slurries in water with continuous stirring to obtain the desired addition levels. Pulp mixtures were then adjusted to pH 4.5 with 0.5 N sulfuric acid and stirred 5 min longer before filtering by suction on coarse fritted-glass funnels. Suitable portions of the filtrates were analyzed for starch by the method of Browning et al. (9). Starch retained in pulps was calculated by difference.

Cationic efficiencies of the fatty compounds for pigment color were determined by the spectrophotometric method of Mehlretter et al. (10) and reported as the percentages of anionic Halopont blue RNM pigment color (E.I. du Pont de Nemours and Co.,

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TABLE I

Retention of Starch and Pigment Color by Cellulosic Pulp<sup>a</sup> Containing Various Cationic Fatty Acid Derivatives

Cationic agent	Addition level, <sup>b</sup> %		Additive retained, <sup>c</sup> %	
	Starch	Cationic agent	Starch	Pigment color <sup>d</sup>
A	3	0.03	84	....
	3	0.06	95	....
	1	0.01	88	....
	0	0.06	....	91
B	3	0.03	84	....
	3	0.06	96	....
	1	0.01	88	....
	0	0.06	....	92
C	3	0.03	83	....
	3	0.06	96	....
	0	0.06	....	90
D	3	0.03	92	....
	3	0.06	99	....
	1	0.01	94	....
	0	0.06	....	92
E	3	0.06	99	99
	3	0	50	....
	1	0	60	....
	0	0	....	6

<sup>a</sup> Consistency of cellulosic pulp slurry was 1.2%.

<sup>b</sup> Dry pulp basis.

<sup>c</sup> .... indicates that no starch or pigment color was added and therefore no analyses were made for retention.

<sup>d</sup> Addition level (dry pulp basis) 0.5% where pigment color was used.

Inc.) retained by the treated cellulosic pulp at pH 4.5.

The data (Table I) show an extremely high retention of starch and anionic pigment color in cellulosic pulp by addition of only 0.01% to 0.06% (dry pulp basis) of the cationic fatty acid derivatives. These compounds are expected to find application under practical papermaking conditions.

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## REFERENCES

- Saito, S., *Kolloid-Z.* 154, 19 (1957).
- Scott, J. E., "Methods in Biochemical Analysis," Vol. 8, Interscience Publishers, New York, 1960, p. 160.
- Fishman, M. M., and R. S. Miller, *J. Colloid Sci.* 15, 232 (1960).
- Black, W. C., and V. L. Winfrey (Penick & Ford Ltd.), U.S. Patent 3,320,118 (1967).
- Kent, S. E. (Hodag Chemical Corporation), U.S. Patent 3,471,362 (1969).
- Mehlretter, C. L. (U.S. Dept. Agr.), U.S. Patent 3,477,904 (1969).
- Pattloch, D. K. (Talbot Development Associates), U.S. Patent 2,694,633 (1954).
- Mehlretter, C. L., *JAOCS* 44, 219-220 (1967).
- Browning, B. L., L. O. Publitz and P. S. Baker, *Tappi* 35, 418 (1952).
- Mehlretter, C. L., F. B. Weakley, M. L. Ashby, D. W. Herlocker and C. E. Rist, *Tappi* 46, 506-508 (1963).

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