FedChem
A Subsidiary of Federal Process Corporation

FOOD MACHINERY GREASES

Lubricants for use in equipment for the processing and preparation of foods and beverages where incidental contact may occur must have special characteristics. Not only must the ingredients be safe but these lubricants must be in high quality to provide the extra edge to stand up to the routine cleaning and scouring that this equipment faces. Add to this the wide variety of conditions imposed by such diverse food products as fruit and vegetable juices, milk products, beverages, bakery products, poultry and fish processing and it is easy to see that bearings must be protected by exceptional lubricants.

The aluminum complex soap is specifically noted in the Code of the Federal Register (CFR) 21:178.3570 as an acceptable thickener system in concentrations as high as 10% based on the weight of the mineral oil. It should be noted that the aluminum source is not listed as an ingredient. The CFR requires only that the thickener system, the aluminum stearoyl benzoyl hydroxide, be listed. For this reason, the Kolate product does not need an FDA clearance. All other components do need approval. The stearic acid component of the soap however, must meet the specifications listed in the CODEX of the FDA and they are as follows:

Acid value	Between 198 and 211
Heavy metals (as Pb)	Not more than 10mg/kg
Iodine value	Not more than 7
Residue on ignition	Not more then 0.1%
Saponification value	Between 197 and 212
Titer ºC	Between 54.5º and 69º
Unsaponifiable matter	Not more then 1.5%
Water	Not more then 0.2%

The two aluminum products most commonly used for FM greases are Kolate LV and Kolate 6030. The former is the normal Kolate using a light technical white oil (CAS# 8042-47-5) as the carrier. This product contains 12.7% aluminum by weight. During the formation of the soap, one mol of isopropyl alcohol is released for each mol of aluminum. With Kolate 6030, no alcohol is released and a portion of the needed fatty acid and benzoic acid are provided. It uses the same technical white oil as Kolate LV.

With either product, the procedure is the same; the acids required are heated in most of the oil to a temperature of 95ºC to 100ºC. The Kolate is added and, with stirring, the batch is heated to 200ºC. for a small lab batch, two to three minutes is sufficient to complete the dispersion. For a production run, a holding time of 20 to 30 minutes is necessary.
In a plant production run, cooling is best accomplished by transferring to a cooling kettle and bringing the temperature down to 125ºC before the additives and adjusting oil are introduced. In a lab batch, the sample can be discharged to cool before making the additions of oil and additives.

Milling is generally recommended to improve the final yield and appearance but in most cases, only a light setting is needed.

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Typical Starting Formulation For Base Grease

This formulation, using Kolate LV, and shown on a weight percent basis, is built around a 6.5% soap. It represents a mol ratio on 0.7 benzoic acid to fatty acid; and 1.9 total mols of acids to aluminum.

4.65 fatty acid (Acid Number 204)
1.44 benzoic acid
0.41 aluminum (3.23 parts of Kolate LV @ 12.7% will provide 0.41 parts of 100% aluminum)
6.50 soap

5.0 additives

88.5 white oil
100.00

NOTE: 3.23 parts of LV also contain 1.7 parts of oil. Therefore, oil to add is 86.8 parts.

With Kolate 6030, 0.6 mols of fatty acid and 0.3 mols of benzoic acid per mol of aluminum are ready present and reacted with the aluminum. It is only necessary to add the balance of the two acids to achieve the same grease. The formulation is derived as follows:

0.41 parts of aluminum represent 0.0152 mols. This amount also has reacted with it, 2.5 parts of fatty acid and 0.56 parts of benzoic acid. The initial formulation will therefore be adjusted to be:

2.15 fatty acid (assumes same acid number)
0.88 benzoic acid
0.41 aluminum (0.41 parts of aluminum require 7.74 parts of Kolate 6030 of which 4.02 parts are oil)
6.50 soap

5.0 additives

84.48 white oil
100.00

Poly-alpha olefins may also be used as the base fluid although the soap content usually must be increased to 10% to achieve a No. 2 grease. The above information would have to be adjusted to show increased soap and the decrease in the amount of the base fluid. Several additive package choices are shown below with typical results.

A.	3.0% tetra sodium pyrophosphate	Rhodia
	0.5% Amine O	Ciba-Geigy
	0.5% Sarcosyl O	Ciba-Geigy
	0.5% L-64	Ciba-Geigy
	0.5% Heveatex H1501	Heveatex Corp
	5.0%	

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B.	3.0% tetracalcium pyrophosphate	Monsanto
	0.5% Amine O	Ciba-Geigy
	0.5% Sarcosyl O	Ciba-Geigy
	0.5% L-64	Ciba-Geigy
	0.5% Heveatex H1501	Heveatex Corp
	5.0%	

C.	4.0% tricalcium phosphate	Rhodia
	0.5% Amine O	Ciba-Geigy
	0.5% Sarcosyl O	Ciba-Geigy
	0.5% L-64	Ciba-Geigy
	0.5% Heveatex H1501	Heveatex Corp
	6.0%*	

* Note that with a 6% package, the total oil for the formulation should be decreased to 87.5.

D.	4.0% ALBAGLOS	Pfizer
	0.5% Amine O	Ciba-Geigy
	0.5% Sarcosyl O	Ciba-Geigy
	0.5% L-64	Ciba-Geigy
	0.5% Heveatex H1501	Heveatex Corp
	6.0%	

Typical Results From The Formulations On The Previous Page:

Sample	A	B	C	D
Penetrations				
P-60	285	297	270	290
@P-10000	+26	+28	+20	+13
Drop point				
D2266	258ºC	271ºC	270º	276º
	497º	520ºC	518º	529º
Wear, 4-ball				
D2266	0.48mm	0.43mm		0.55mm
0.55mm				
E.P., 4-ball				
D2569	315 Kg	250 Kg	315 Kg	215 Kg
Corrosion				
D1743	pass	pass	pass	pass

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For additional information see "FULLY FORMULATED (H-1) ALUMINUM COMPLEX FOOD MACHINERY GREASES" C. KYRIAKOPOULOS, N.L.G.I. SPOKESMAN, Vol. 58, No. 4, July 1994.

LUBRICANS FOR USE IN EQUIPMENT FOR THE PROCESSING AND PREPERATION OF FOODS AND BEVERAGES ARE SUBJECT TO APPROVAL AND REGULATION BY THE U.S.D.A. ALL COMPOSITIONS MUST BE PREPARED FORM MATERIALS APPROVED BY THE FDA. CFR HAS LISTED THE MATERIALS ACCEPTABLE FOR INCORPERATION IN GREASE FORMULATIONS. ADDITIONAL ITEMS ARE LISTED IN SOURCES FROM THE U.S.D.A.