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INFORMATION

PURE-SOB

PURE SORB is Messina's trademark name for a group of products specifically designed to provide the highest quality separation product available for use in the chemical, petrochemical, and petroleum industries.

This high quality material comes in two different forms, PURE-SORB-A or PURE- SORB-B.

These two products variate depending upon performance requirements by the customer, cost limitations, etc.

PURE-SORB-A

This products is commonly used where absorbancy, decolorization, clarification, neutralizing, or deodorizing is required. PURE-SORB-A has substantially improved in adsorptive efficiency by high-pressure extrusion and other special processes that were developed and introduced by Messina. This special processing increases the available surface area and also results in a decided improvement in the selective absorption characteristics. PURE-SORB-A is recommended for all applications where good adsorption capacity is essential. It is particularly applicable to filtering operations, the purpose of which is to decolorize, clarify, neutralize, deodorize, and remove taste. PURE-SORB-A comes in a variety of particle sizes, including 16/30, 30/ 60, as well as finer sized versions.

• USES FOR PURE-SORB-A

For purposes of decolorization, stabilization, neutralization, and deodorization of solvents, both percolation and contact methods are employed. In the percolation method, the material to be processed is filtered through a column of granular PURE-SORB-A which has been heat activated (usually between 600° and 1200°F.). The rate of percolation, temperature of operation, and optimum temperature of activation of the PURE-SORB-A are variables which should be determined experimentally for a specific application. Granular PURE-SORB-A grade can generally be revivified to their original efficiency by heating in the presence of air to temperatures not exceeding 1200° to 1250°F. Multiple hearth burners such as the Herreshoff and Wedge are commonly used for the regeneration process, but the Therm-for Kiln is considered most efficient. In some cases, regeneration can be accomplished by washing with selected solvents. Typical data for this type of operation are presented in Table A.

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TABLE A Typical Percolation Data Plant Basis

(Optimum treating conditions and results depend on the characteristics and previous processing of the oil)

				Filter Yield	
Material to be treated	Temperature of Clay Activation	Temperature of Percolation	Rate of Final Percolation Gal/Ton/Hr	Composite Color of Treated Material*	Gal/Ton
Kerosene	1000-1100°F	Cold	50-200	28 Say	2,000-16,000
Neutral	700-1100°F	75-150	10-30	21/2 NPA	200-10,000
White Oil	600-800°F	75-130	10-100	Water (white)	500-4,000
Bright Stock (40% soln. in Naphtha)	1000-1200 °F	130-160	10-40	7 NPA (stock)	200-3,000
Petrolatum	1000-1100 °F	175-250	5-20	2.5 Y.Lov. (snow white)	30-200

*The color becomes progressively darker as the clay is exhausted, and the endpoint is selected arbitrarily

In the Contact method, the material to be treated is mixed with one of the fine mesh grades of PURE-SORB-A and the slurry stirred for periods of 5 to 30 minutes at elevated temperatures under an inert atmosphere. The treated product is recovered by filtering through a plate-and frame or continuous type filter. For optimum results, the amount of PURE-SORB-A used, temperature, and time of treatment should be determined by experiment. The economics of plant operation rarely merit a regeneration step for fine mesh grades. Typical results for this process will be found in Table B.

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TABLE A TYPICAL CONTACT DATA

(Optimum treating conditions and results depend on the characteristics and previous processing of the oil)

Material to be Treated	Weight, Percent Clay Used	Temperature of Contact	Time of Contact
VEGETABLE OILS			
Linseed Oil	4 to 10	180-220°F	10 to 30 min
Rape Oil	2 to 4	180-220°F	10 to 30 min
Castor Oil	1 to 4	Low Temp	As required
Cottonseed Oil	2 to 5	230-260°F	15 to 45
Peanut Oil	½ to 5	Low Temp	10 to 30
Poppy Seed Oil	½ to 5	Low Temp	10 to 30
Olive Oil	½ to 5	Low Temp	10 to 30
Mustard Seed Oil	2 to 4	180-220°F	10 to 30
Sunflower Seed Oil	3 to 5	212-284°F	20 to 30
Soybean Oil	4 to 10	230-260°F	15 to 45
ANIMAL OILS			
Lard, Tallow	½ to 3	150°F	20 to 30
Bone Oil	3 to 5	155°F	30
Fish Oil	3 to 5	120-200°F	15 to 30
Beeswax	3 to 8	250-300°F	30
Skin Glue	½ to 1	250°F	15
PETROLEUM OILS			
Neutral	1 to 8	150-300°F	10-60
Bright Stock	5 to 15	250-700°F	10-60

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CATALYST AND CATALYST CARRIER

Pinene, turpentine, and other terpene liquids are polymerized with PURE-SORB-A as a catalyst. The reaction is highly exothermic. One of the important products of this reaction is the formation of camphene from which synthetic camphor is produced. PURE-SORB-A, impregnated with copper salts, is used to "sweeten" naphthas and gasolines in the Linde and Perco Processes. PURE-SORB-A is used in the Gray process to remove gum-forming constituents from gasolines and light distillates. It is used as a catalyst in the vapor-phase catalytic desulfurization of gasoline and gasoline blending stocks.

In this type of catalytic work, operating temperatures range from 700°F to 750°F with throughputs of 0.5 to 2.0 volumes of feed per hour per volume of catalyst. Typical desulfurization data are presented in Table C. The PURE-SORB-A catalyst can be regenerated 'in situ' by passing an oxygen-containing gas through the bed. In those refineries where multiple-hearth burners are available, the PURE- SORB-A may be removed and regenerated in the same manner as described for the percolation procedure. Care should be employed to prevent 'overburning' during this step by controlling the revivification temperatures to those not exceeding 1200° to 1250°F.

TABLE C

Feed	West Texas Cracked Blending Stock	Michigan Staightrun Blending Stock
Catalyst	PURE-SORB-A	PURE-SORB-A
Temperature, °F	750	733
L.H.S.V Yield, Bbl/ton	1.0 over 860	0.7 over 20,000

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Inspections Feed Product Feed Product				
Gravity. 60.0	59.9	73.3	73.3
I.B.P., °F. 80	82	96	97
10% @ °F. 122	124	128	128
50% @ °F. 254	256	186	187
90% @ °F. 362	360	240	238
F.B.P., °F. 387	394	306	308
Recovery, %. 95.0	95.5	97.0	97.5
Residue, % 1.5	1.5	0.6	0.7
Reid, V.P., psi 10.3	10.1	10.6	10.6
Doctor Test. . . . . sour	sweet	sour	sweet
Total S, % 215	.147	.062	.018
Mercaptan 071	.000	.013	.000

Octane Nos.				
A.S.T.M. clear.	70.5	72.2	53.6	54.0
+ 3 ml. TEL/gal	78.9	80.7	71.5	76.5
Research clear.	73.6	73.8		
+ 3 ml. TEL/gal	83.6	86.9		

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MISCELLANEOUS USES

The unique properties of PURE-SORB-A provide it with the ability to act in almost opposite ways when used as a soil conditioner. Unactivated, it provides sandy, porous-type soils with the needed "body" to adsorb and hold moisture and plant nutrients. Activated, it becomes a hard granule which provides porosity to clay- type soils.

Due to its relatively high cation exchange capacity, PURE-SORB-A can be used to adsorb radioactive ions from atomic energy waste solutions.

Heat-activated, granular grades of PURE-SORB-A can be used as desicants to remove water from gas and liquid fluids. It is particularly applicable where the cost of the adsorbent is of grater importance than an extremely low dew-point. the desiccant action is completely reversible and the PURE-SORB-A can be restored to its original moisture adsorption capacity by the action of heat.

A two-inch thickness of PURE-SORB-A is equivalent in insulation characteristics to one inch of high-grade cork. PURE-SORB-A, therefore, is worthy of consideration in those commercial installations where elevated temperatures up to 1500°F eliminate flammable and sintering type insulating materials.

PURE-SORB-B

PURE-SORB-B is an acid activated clay for improved absorbency, and is divided into three different grades: Grade 1, 20, and 20X. These three variations of PURE- SORB-B are also used for absorbency, decolorization, clarification, neutralizing, or deodorizing purposes, and they each are characterized by their various applications.

APPLICATIONS

Acid activated clays find application in three major areas: refining oils, fats, and solvents; catalysis; and as color developers for dyes impregnated in carbonless copy paper. Although the actual dosage amount of clay used for refining applications is typically quite low, the bulk of the business for acid-activated clays (70% to 80%) falls in this area as a consequence of the enormous volumes of oils and solvents being processed. The remainder of the business is split between the latter two applications, the ratio of that split depending on regional demands (e.g., acid-activated color developing clays are commonly used in Europe and Japan, but acidic ion-exchange resins are more commonly used in the US)

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Major Applications for Acid-Activated Clays		
Application	**Function**	**Method of Use**
Refining agent for oils and solvents	Edible and inedible oils: decolor- ization and stabilization by re- moval of colored pigments and impurities	1/4-4% clay dosage; heated under vacuum for 15-30 in @ 212-250°F; then filtered.
	Used lubricant oils: reclamation by removal of degradation prod- ucts and contaminants	3-5% clay dosage; heated w/ steam to 390-575°F for 10-30 min; then filtered.
	BTX refining: olefin removal and decolorization	Fixed bed contact @ 170-200°C.
Catalysis	Acid-catalyzed reactions: poly- merizations, alkalyations, esteri- fications, isomerizations, and fatty acid dimerizations	Reagents either passed over bed of granulated catalyst par- ticles or added to reagents in powder form; usually at moderate to high reaction temperatures.
Carbonless copy pater	Color deveoper: developing color of microencapsulated dye beads on copy paper	20-30% clay dosage in coating mixture (calcium carbonate and dispersant); coating spread on front of bottom (copy) sheet.

Because different applications and various degrees of performance for a given application are often required by customers, larger manufacturers are required to maintain rather extensive product lines. This requirement places additional demands on the manufacturer because he must maintain flexibility in his plant while still delivering product consistency.

What these applications have in common is the fact that they utilize the same property of acid-activated clays, namely, acidity. In refining, the acid functionability of the activated clay serves to enhance the clay surface. In catalysis, the activated clay donates protons (H^+) or Brönsted acidity to reactant molecules, thereby promoting various acid-catalyzed reactions (Ballantine et al., 1981, 1983; Adams et al., 1982, 1982a, 1983; Atkins et al., 1983; Gregory et al., 1983), such as alkylations, esterifications.

Although beyond the scope of this paper, other catalytic reactions using post- modified clays exchanged with active metals (Robschlager et al., 1984; Heinerman et al., 1983), metal complexes (Raythatha and Pinnavaia, 1983; Pinnavaia et al., 1984) are also possible.

In the carbonless copy paper application, the acid clay works by donating protons to leuco dye molecules, thereby changing them from their normal colorless (unprotonated) state into their colored (protonated) analog. Fahn. and Fenderl (1983) have written an excellent paper is on this subject.

GRADE 1

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PURE-SORB-B(GRADE 1) is an activated adsorbent for general purpose decolorization of animal, vegetable and mineral oils and waxes. This product is uniquely characterized by its high bleaching efficiency, fast filtration rate and low oil retention.

This particular grade of PURE-SORB-B is recommended for decolorization of fats and oils, waxes, soap stocks, fatty acids, sulfur and petrochemical applications

GRADE 20

PURE-SORB-B(GRADE 20) is an activated adsorbent designed for general purpose use in decolorizing and otherwise purifying petroleum based oils and hard-to- bleach fatty oils. This product is characterized by its high adsorbent efficiency and low oil retention.

This grade of PURE-SORB-B is recommended for purification of virgin lubricating oil stocks, the re-refining of automotive drain oil and rolling mill oils as well as the purification and/or reclamation of hydraulic, transformer and other lubricating oil stocks. Purification of hard-to-bleach fatty oils including, but not limited to, cottonseed, soybean, canola and palm. Decolorization of petroleum waxes and other petroleum derivatives.

PURE-SORB-B(GRADE 20X) is an activated adsorbent designed for general purpose use in decolorizing and otherwise purifying oils from petroleum sources. This product is characterized by high adsorbent efficiency, fast filtration rate and low oil retention.

This grade of PURE-SORB-B is recommended for purification of various oil stocks, including tallows, palm oils, virgin lubricating oil stocks, re-refining of automotive drain oil and rolling mill oils, purification and/or reclamation of hydraulic, transformer and other lubricating oil stocks or decolorization of petroleum waxes and other petroleum derivatives.

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PURE-SORB-B TYPICAL PROPERTIES

Moisture	1	20	20X
Free @ 105°C, wt.%loss	15	14	14
Residual Acidity			
mg. KOH/gm. at phenolphthalein endpoint	5	22	13
Particle Size, Tyler Standard Sieve			
Passing 100 mesh, wt.%	97	98	97
Passing 200 mesh, wt.%	85	88	88
Bulk Density			
lbs./cu.ft	32		39
gm./cc	0.51		0.62
Loose	2 lbs/cu. ft		0.51 gm/cc
Bulk	43 lbs/cu. ft		0.69 gm/cc

CHEMISTRY

The enhancement in adsorptive and catalytic activity brought about by acid leaching can be rationalized on the basis of a mechanic model with surface acidity and protonation-exchange phenomena as key points.

The acidic cations present as a consequence of the activation process can donate a proton to a pigment molecule (most have olefinic bonds or other electrophillic bonds susceptible to protonation), thereby yielding a positively charged carbonium ion (organic cation). Since this carbonium ion is nothing more than a large cation and since the disrupted clay structure has considerable surface area, it can easily accomodate the presence of large cations like carbonium ions via the normal cation exachange processes characteristics of these clays.

Considerable evidence supports the idea that such carbonium ions associate strongly with montmorillonite clay surfaces. Once in place, they are anchored by electrostatic attractive forces to the negatively charged clay layers. The same mechanism operates when these clays are used as color developers for the encapsulated dyes incorporated in carbonless copy paper except, in this case, the protonated dye molecule is changed from a colorless to a colored state when protonated.

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ENVIRONMENTAL CONSIDERATION

The manufacturer of bleaching clays has two major environmental concerns that he must address: the restoration of his mine as he works the clay deposit, and the disposal of spent acid solution from the activation process. In developed countries, restoration is absolutely essential and usually entails setting aside fertile top soil until the clay layer has been removed, back filling with overburden, and then finally with the top soil. This method allows mining and reclamation to occur simultaneously; therefore, the majority of the reclamation costs are incurred during the mining operation. Alternatively, in some cases, the mined area can be turned into a lake.

The second problem is particularly acute in countries with strict water pollution laws. The acidified sour water from clay activations is laden with aluminum salts that are quite toxic to aquatic life (Robinson and Deano, 1986; lamb and Bailey, 1981). In the US, strict limits are set on the levels of aluminum salts that can be released to streams and rivers and, as a consequence, manufacturers must find some means of controlling their liquid wastes.

Commonly, producers neutralize their effluent (to precipitate the aluminum salts as insoluble aluminum hydroxides), which can then be disposed of in an appropriate landfill site.

Alternatively, deep well injection can be used to dispose of these wastes. In any case, considerable additional effort and expense are involved in meeting this difficult environmental requirement.