

# The Complete Book on Emulsifiers with Uses, Formulae and Processes (2nd Revised Edition)

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Emulsifier is an organic compound that encompasses in the same molecule two dissimilar structural groups e.g. water soluble and a water insoluble moiety. It is the ingredient which binds the water and oil in a cream or lotion together permanently. The composition, solubility properties, location and relative sizes of these dissimilar groups in relation to the overall molecular configuration determine the surface activity of a compound. Emulsifiers are classified on the basis of their hydrophilic or solubilizing groups in to four categories anionic, non ionic, cationics and amphoteric. Emulsifier is utilized in various industries; agriculture, building and construction, elastomers & plastics, food & beverages, industrial cleaning, leather, metals, paper, textiles paints & protective coatings etc. An emulsion is an ideal formulation for the administration. The emulsion form allows uniform application of a small amount of active ingredient on the surface of the skin. Some of the important emulsions in different field are pharmaceutical emulsions, rosin & rubber emulsion, textile emulsions, pesticide emulsions, food emulsions, emulsion in paint industry, emulsion in polish industry, leather & paper treatment emulsions etc. Various cosmetics creams, such as moisturizers, contain emulsifiers. Lighter, less greasy feeling creams are oil in water emulsions; heavier creams used to treat rough skin are water in oil emulsions, with oil as the main ingredient. Liquid soaps, toothpastes and other body care products also contain emulsifiers. Emulsifiers have the ability to optimize the concentration of certain nutrients in an emulsion. For example, in hair conditioners, some conditioning agents can damage hair if not properly diluted in the solution. Emulsifiers are among the most frequently used types of food additives. Emulsifiers can help to make a food appealing. Emulsifiers have a big effect on the structure and texture of many foods. Increasing demand for low fat food among health conscious consumers is gradually driving the market for emulsifiers. Besides stabilizing emulsions, emulsifiers derived from non hydrogenated fats help in maintaining sensory characteristics of food such as texture, flavor, and taste that are often lost due to fat reduction. This characteristic of making healthier products similar in taste to fat containing versions has enabled emulsifiers in gaining widespread acceptance in the market. The global food industry is also witnessing increase in demand for multipurpose emulsifiers that perform functions of both stabilization and emulsification. Some of the fundamentals of the book are characteristics and application of emulsifiers, wetting and detergent structures in emulsifier, effect of surfactant on the properties of solutions, wetting characteristics of emulsifiers, formulated emulsifiers, non surfactant functional additives, inert fillers, functional surfactant additives, uses of emulsifiers, household and personal products, industrial uses of emulsifier, anionic surfactants, non ionic surfactants, cationic, amphoteric and enzyme, alkylolamides, vinylarene polymers, alkyl sulfates, ethoxylation processes, application of emulsifiers, etc. The

present book contains manufacturing processes of various types of emulsifiers which have applications in different industries, along with photographs of machinery and equipments. This is a resourceful book for scientists, technologists, entrepreneurs and ingredients suppliers.

## 1. Characteristics and Application of Emulsifiers

Introduction, Classification of Emulsifiers, Solubility & Surface Activity of Emulsifiers, Wetting and Detergent Structures in Emulsifier, Effect of Surfactant on the Properties of Solutions, Wetting Characteristics of Emulsifiers, Micellar Solubilization of Emulsifiers, Formulated Emulsifiers, Non-Surfactant Functional Additives, Inert Fillers, Functional Surfactant Additives, Uses of Emulsifiers, Household and Personal Products, Industrial Uses.

## 2. Industrial Uses of Emulsifier

Agriculture, Building and Construction, Elastomers and Plastics, Food and Beverages, Industrial Cleaning, Leather, Metals, Paper, Paints and Protective Coatings, Petroleum Production and Products, Textiles, Biodegradable Emulsifiers and Water Pollution, Biodegradation, Water Pollution, Recent Trends.

## 3. Anionic Surfactants

Introduction, Carboxylates, Soap, N-Acylsarcosines, Acylated Protein Hydrolysates, Sulfonates, Alkyl benzene Sulfonates, Petroleum Sulfonates, Dialkyl Sulfosuccinates, Naphthalene Sulfonates, N-acyl-N-alkyltaurates, 2-Sulfoethyl Esters of Fatty Acids, Olefin Sulphonates, Sulfates & Sulfated Alcohols (Sulfated Alcohols), Sulfated Natural Fats and Oils, Sulfated Alkanolamides, Sulfated Esters, Ethoxylated and Sulfated Alkyl phenols, Ethoxylated and Sulfated Alcohols, Phosphate Esters.

## 4. Non-Ionic Surfactants

Introduction, Polyoxyethylene Surfactants, Ethoxylated Alkyl Phenols, Ethoxylated Aliphatic Alcohols, Carboxylic Esters, Glycerol Esters, Polyethylene Glycol Esters, Anhydrosorbitol Esters, Ethoxylated Anhydrosorbitol Esters, Glycol Esters of Fatty Acids, Ethoxylated Natural Fats, Oils and Waxes, Carboxylic Amides, Diethanolamine Condensates, Monoalkanolamine Condensates, Polyoxyethylene Fatty Acids Amides, Polyalkylene Oxide Block Copolymers, Polyoxypropylene-Polyoxyethylene Derivatives, Organosilicones Derivatives.

## 5. Cationic, Amphoteric and Enzyme Detergents

Cationic Detergents, Amines not containing Oxygen, Oxygen-Containing Amines, Except Amides, Amine Oxides, Polyoxyethylene Alkyl and Alicyclic Amines, 2-Alkyl-1-(hydroxyethyl)-2-imidazolines, N, N, N', N'-Tetrakis-substituted Ethylenediamines, Other Miscellaneous Cationic Surfactants, Amines Having Amide Linkages, Quaternary Ammonium Salts, Amphoteric Surfactants, Enzyme Detergents.

## 6. Sulfonated Oils

Historical Background, Chemistry of Sulfation and Sulfonation, Applications of Sulfonated Oils, Manufacture of Sulfonated Oils, Sulfation, Sulfonation, Sulfation of individual Oils, Characteristics and Analysis of Sulfonated Sulfated Oils.

## 7. Alkylolamides

Introduction, Alkylolamides in Shampoo Formulations, Chemistry of the Alkylolamides, Mono-

Alkylolamides, Di-Alkylolamides, Pure Di-Alkyl olamides, Phosphoxylated Alkylolamides, Sulphated Alkylola- mides, Foam Stabilization, Manufacture of Alkylol- amides, Coconut Fatty Acid Die thanolamide, Lauric Acid Dieth anolamide, Oleic Acid Monoethan olamide, Stearic Acid Mono ethanolamide.

#### 8. Vinylarene Polymers

Monomers, Anionic Polymerization, Polymer

Reactions, Stereoregular Polymerization, Cationic Polymerization, Free-Radical Polymerization, Polymer Properties, Electrical Proper- ties, Utility and Application.

#### 9. N-Acyl-N-Alkyltaurates

Introduction, Applications of Igepon T Products, Future of Igepons, Manufacture of Igepon T, Raw Materials, Oleic Acid Chloride, Igepon T Gel, Igepon T Powder, Chemical Control, Utilities, Materials of Construction.

#### 10. Vinylamine Polymers

Preparation, Polymerization Followed by Hydrolysis, Polymerization Followed by Reduc- tion, Hofmann Degradation of Poly(acrylamide), Polymerization Kinetics, Copolymers of Vinyl-,Amine Properties, Chemical Reactions of Poly (vinyl-mine), Uses.

#### 11. Alkyl Sulfates

Introduction, Manufacture of Alcohols, Properties and Performance Characteristics of Alkyl Sulfates, Krafft Point, Critical Micelle Concentration, Surface and Interfacial Tens- ions, Wetting Time, Foam Height, Detergency, Dishwashing Test, Emulsion Stability, Manufacture of Alkyl Sulfates, Sulfation with Chlorosulfonic Acid, Sulfation with Sulfuric Acid, Sulfation with Sulfur Trioxide, Manufacture of Alkyl Sulfated on Large Scale, Formulated Products from Alkyl Sulfates.

#### 12. N-Vinyl Amide Polymers

Monomers, Manufacture, Polymerization, Properties of Poly( vinyl Amides), Other Poly (vinyl Amides), Uses, Cosmetics and Toiletries, Textiles and Dyes, Pharmaceuticals, Adhesives, Beverage Clarification, Miscellaneous Uses, Specifications and Standards, Analytical and Test Methods, Health and Safety Factors.

#### 13. Olefin Sulfate and Sulfonates

Introduction, Olefin Sulfates, Raw Materials and Product Composition, Olefin Sulfates from Shale Oil, Olefin Sulfate from Wax Cracked Distillates, Sulfation, Neutralization and Hydrolysis, Evaporation, Finishing, Solvent Recovery, Olefin Sulfates, Introduction, Products of Sulfonation, Manufacture of Olefin Sulfonates Introduction, Batch Sulfonation, Continuous Sulfonation, Sulfonation with Dioxane- SO<sub>3</sub> , Characteristics & Surface Active Properties of Olefin Sulfonates, Formulated of Heavy-Duty Detergents with Ole fin Sulfonates.

#### 14. Ethoxylation Processes

Introduction, Ethoxylated Alkyl Phenols, Laboratory Method of Preparation, Batch Ethoxylation Unit, Properties of Ethoxylated Alkyl Phenols.

#### 15. Ethoxylated Fatty Alcohols

Introduction, Laboratory Method of Prep- aration, Continuous Ethoxylation Unit, Properties of Ethoxylated Fatty Alcohols, Solubility, Cloud Point, Surface and Interfacial Tension, Detergency, Wetting Properties, Foaming Properties, Emulsifying Properties, Ethoxylated Fatty Acids, Introduction, Manufacture, Properties of Fatty Acid Ethoxylates, Ethoxylated Fatty Amines, Formulations.

## 16. Alkyl Phenol Ether Sulfates

Introduction, Sulfation and Sulfonation, Manufacture of Alkyl Phenol Ether Sulfates, Sulfamation, Nonylphenol 4-ethoxy Sulfate, Di-(isohexyl / isoheptyl)phenol Ether Sulfate, Dodecylphenol Ether Sulfate, Sulfation with Sulfur Trioxide, Comparison of Sulfation with Sulfur Trioxide and Sulfamic Acid, Properties and Performance Characteristics of Alkyl Phenol Ether Sulfates.

## 17. Alkyl Ether Sulfates

Introduction, Properties & Performance Characteristics of Alkyl Ether Sulfates, Individual Alkyl Ether Sulfates, Tallow Alcohol Ether Sulfates, Manufacture of Alkyl Ether Sulfates, Process Development, Manufacture of Alcohol Ether Sulfates, Formulated Products From Alkyl Ether Sulfates.

## 18. Fatty Amine Oxides

Introduction, Manufacture of Fatty Amine Oxides, Routes to Fatty Amines, Amine Oxidation, Commercial Synthesis, Properties and Analysis of Fatty Amine Oxides, Amine Oxide Properties, Analytical Methods, Formulations and Use of Fatty Amine Oxides, Light-Duty Liquids, Heavy Duty Formulations.

## 19. Bisquaternary and Other Cationic Softeners

Introduction, Preparation of Bisquaternaries, 2-Butene-Bridged-Bisquaternaries, Diphenyloxide-Bridged-Bisquaternaries, Diethyleneoxide-Bridged-Bisquaternaries, p-Xylylene-Bridged-Bisquaternaries, 2-Butyne-Bridged-Bisquaternaries, Performance Evaluation of Softeners, Multiwash Softeners Evaluation, Softness Evaluation, Rewettability Measurements, Performance Characteristics of Bisquaternaries and Other Cationic Softeners, Softener Concentration, Fabric Rewettability Measurements.

## 20. Other Miscellaneous Emulsifiers

### (i) Alkyl Naphthalene Sulfonates

Introduction, General Method of Manufacture, Nekal 'BXG'; Nekal 'BX' Extra Strong, Dibutyl Naphthalene Sulfonate, Diamyl Naphthalene Sulfonate.

### (ii) Sulfated Alkylolamides

Introduction, Igepon 'B' Paste, Igepon 'C' Paste, Sodium-N-2-hydroxyethyl-hexadecanamide H Sulfate.

### (iii) Sodium B-Sulfoethyl Esters of Fatty Acids

Introduction, Manufacture of Igepon A.

### (iv) Polyethylene Glycol Fatty Acid Esters

Introduction, Manufacturing Process, Fatty Acid Esters of Sucrose.

### (v) N-Acylsarcosinates

Introduction, Manufacture of Sodium N-Oleoylsarcosinate.

### (vi) Sulfated Monoglyceride

Introduction, Manufacture.

## 21. Application of Emulsifiers

### (i) Pharmaceutical Emulsions

Introduction, Cod Liver Oil Emulsions, Ointments, Beeler's Base, Washable Ointment Base, Greaseless Base, Ointment Washable Type, Steroidal Emulsion, Aeriflavine Ointment, Aluminium Acetate Lotion, Typical Antibiotic, Anesthetic and Anti-Inflammatory Ointment, O/W Type Benzyl Ointment, O/W Boric Acid Ointment, W/O Calamine Cream, W/O Emollient Ointment, Solubilized Hexachlorophene, O/W Oxyquinoline Sulphate Ointment, Penicillin Ointment.

(ii) Rosin and Rubber Emulsion

Rosin Emulsion, PVA Resin Emulsion, Pentaerythritol Abietate Emulsion, Methyl Methacrylate Emulsion, Polystyrene Resin Emulsion, Polyvinyl Ether Emulsion, Synthetic Rubber Emulsion Polymerization, Chlorinated Rubber Emulsion, Wall Tile Adhesive, Black Industrial Cement, Reclaim Asphalt Dispersion Cement, General Purpose Cement, Rubber Dressing.

(iii) Textile Emulsions

Antistatic Textile Dressing, Lustre Emulsion for Starching, Root proofing Emulsion, Textile Softeners, Textile Gloss Oil, Yarn Finish, Soluble Textile Oil, Rope Preservative, Synthetic Thread Lubricant, Acetate Rayon Oil, Screen Printing Emulsion, Mineral Oil Emulsion, Rayon Delustering.

(iv) Pesticides Emulsions

Malathion Wettable Powder, Dieldrin Formulation, Lindane Formulation, Ronnel Formulation, Butyl Ester of 2, 4-D Formulation, Fruit Coating Wax Emulsion, Cattle Dips, DDT Formulation, Chlordane Formulation, Heptachlor Formulation, Aldrin Formulation, Endrin Emulsion Concentrate.

(v) Food Emulsion

Chocolate Milk, Stabilized, Artificial Cream, Lemon Oil Emulsion, Transparent Lemon Oil Emulsion, Orange Emulsion, Bitter Almond Emulsion, Butter Substitute, Mayonnaise, Salad Dressings, Coffee Whitener Liquid, Coffee Whitener (Spray Dried), Ice Cream Mix, Pickle Flavour Emulsion, Starch Paste.

(vi) Emulsions in Paint Industry

Flat Interior Paint, Semi gloss White Latex Paint, Gloss Emulsion Paint, Exterior Latex Paint, Exterior White Paint, Interior White Paint, Resin Oil Emulsion.

(vii) Emulsions in Polish Industry

Automobile Polish, 'Dry Bright' Floor Polish, Paste Polishes, Mineral Oil Emulsion Polishes, Silicone Polishing Cloth, Paste Type, Automobile Cleaner Polish.

(viii) Leather and Paper Treatment Emulsions

Leather Finishes, Fat Liquors, Leather Dressing, Shoemaker's Wax Burnishing Polish, Softner for Leather Goods, Leather Pasting, Coating for Paper, Water Resistant Coating for Paper, Grease Resistant Paper Coating.

(ix) Cutting Oils, Soluble Oils, Miscible Oils

Naphthenic Miscible Oils, Cutting Oils, Mold Release Compound.

(x) Cleaners

All Purpose Cleaners, Pine Base Cleaner, Hand Dishwashing Detergent, Machine Dish- washing Liquid, Household Heavy Duty Detergent, Household Light Duty Detergent, Fine Fabric Detergent, Hydrogen Peroxide Emulsions, Floor Wax Remover, Rug Cleaner, Shoe Cleaner, Waterless Hand Cleaners, Acid

Aluminium Cleaner, Copper Cleaner, Degreaser Formulation, Light Duty Steam Cleaner, Alkaline Cleaner, Mercerization Formulation, Powdered Caustic Bottle Washing Compound, White Wall Tire Cleaner.

## 22. Determination of Physical Surface

### Active Characteristics of Emulsifiers

Introduction, Physical Characteristics, Density of Powdered Detergents, Apparent Bulk Density, Cup Density, Particle Size of Powdered Detergents, Hand Sieving, Machine Sieving, pH and Alkalinity, Free Alkalinity, Cloud Point of Non-ionic Detergents, Viscosity, Surface-Active Properties, Ring Method, Experimental Procedure, Determination of Surface Tension, Determination of Interfacial Tension, Calculation of Surface Tension, Calculation of Interfacial Tension, Performance Characteristics, Dishwashing Tests, Laundry Evaluation, Split Item Tests, Bundle Test, Foam Tests, Dynamic Foam Test, Pour Foam Test, Wetting Test, Canvas Disc Test, Skein Test.

## 23. Analysis of Emulsifiers

Introduction, Separation of Surfactants, Identification of Components, Anionics, Cationics, Nonionics, Determination of Surfactants, Total Organic Active Ingredient, Procedure, Correction for Sodium Chloride Content, Anionic Surfactants, Preliminary Estimate of Mol. Wt., Titration with Cationic Surfactants, Preparation and Standardization of Titrant, Titration of Sample, Amine Complexation Method, Determination of Alkylaryl Sulfonates, Determination of Alkylaryl Sulfonates in the Presence of Short Alkyl Chain Sulfonates, Determination of Fatty Alcohol Sulfates, Cationic Surfactants, Determination of Amine Oxides, Non-Ionic Surfactants, Column Techniques, Batch Technique, Tooth Powders, Bath Powders, Light-Duty Liquid Detergent.

## 24. Photographs of Machinery and Equipments

Vacuum emulsifying machine-lift cylinder, Vacuum emulsifying machine-lift cylinder, Vacuum emulsifying machine-mini split, Grinding Machine, Stirrer Homogeneous Emulsifier, Corrosion-Resistant Filling Machine, Storage Tank, Vacuum Cream Emulsifier Mixer, Vacuum Homogenizer, Meat Emulsifier, Industrial Emulsifier, Dispersing Machine, Sigma Mixer.

## About NIIR

**NIIR PROJECT CONSULTANCY SERVICES (NPCS)** is a reliable name in the industrial world for offering integrated technical consultancy services. NPCS is manned by engineers, planners, specialists, financial experts, economic analysts and design specialists with extensive experience in the related industries.

Our various services are: Detailed Project Report, Business Plan for Manufacturing Plant, Start-up Ideas, Business Ideas for Entrepreneurs, Start up Business Opportunities, entrepreneurship projects, Successful Business Plan, Industry Trends, Market Research, Manufacturing Process, Machinery, Raw Materials, project report, Cost and Revenue, Pre-feasibility study for Profitable Manufacturing Business, Project Identification, Project Feasibility and Market Study, Identification of Profitable Industrial Project Opportunities, Business Opportunities, Investment Opportunities for Most Profitable Business in India, Manufacturing Business Ideas, Preparation of Project Profile, Pre-Investment and Pre-Feasibility Study, Market Research Study, Preparation of Techno-Economic Feasibility Report, Identification and Section of Plant, Process, Equipment, General Guidance, Startup Help, Technical and Commercial Counseling for setting up new industrial project and Most Profitable Small Scale Business.

NPCS also publishes various process technology, technical, reference, self employment and startup books, directory, business and industry database, bankable detailed project report, market research report on various industries, small scale industry and profit making business. Besides being used by manufacturers, industrialists and entrepreneurs, our publications are also used by professionals including project engineers, information services bureau, consultants and project consultancy firms as one of the input in their research.

Our Detailed Project report aims at providing all the critical data required by any entrepreneur vying to venture into Project. While expanding a current business or while venturing into new business, entrepreneurs are often faced with the dilemma of zeroing in on a suitable product/line.

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