CHEMICAL SPECIALTIES

A Symposium

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Preface

This book is intended to be a guide to all those who would like to build up a chemical specialty business. Its purpose is to teach the elements of chemistry to the businessman and give the necessary business information to the chemist.

In the first place, information is given for those who are interested in chemistry but have not had the opportunity to study chemistry. There are many who have not had the advantages of a college training and technical education but who, nevertheless, started to manufacture chemical specialties and succeeded in developing a good livelihood and even a large business in this field. In most cases, they obtained the knowledge necessary for their business in a very hard way. They learned chemical compounding by reading, consulting chemists and making countless experiments.

In this book, all that many successful businessmen have learned from various sources over a great period of time has been put together and arranged for easy use. All the information that a beginner may need will be found in concentrated form here. No theory, chemical equations, or complicated mathematical formulae are used, so that everyone who can read will be able to learn how to make chemical preparations.

Not only the businessman will find this book a useful guide to build up a chemical specialty business, the chemist, also, will find it of great value. The chemist, of course, will know most of the simple chemical information given here, but the formulas listed may inspire him to prepare others of his own. He will find many valuable suggestions on the business part of specialty manufacturing, e.g., figuring costs, marketing, information on where to buy, credits, etc.

It is hoped that this book will help all those who have longed to enter this field but who have been held back by lack of sufficient information.

Preface II

All the formulas are new and up-to-date and suppliers of trademark chemicals are given. Regulations of Food & Drug Regulations covering chemical specialties have been added. Futher information is included on starting a new business.

Contents

Introduction

To start a chemical specialty business, e.g. to manufacture disinfectants, stain removers, cosmetics, etc., little capital is required. No factory is needed. Manufacturing may be started in a kitchen or basement. You can start alone without other employees. The initial equipment need only be a simple balance, pots, pans, jars and wooden mixing paddles along with a source of water and heat. A batch of a particular product can be started and finished, in most cases, within a very short time. The product can then be packaged and be ready for sale. It can be seen that a chemical specialty business is theoretically, fairly simple to start. Anyone who has some business ability may enter into it. Many a business, which was started on a small scale, is of outstanding importance today. This does not mean, of course, that every small business will prosper. However, it proves that the opportunity is there for all those who are properly equipped, ambitious, and really willing to work hard and continuously, not only when they feel like doing so.

A chemical specialty business is usually based on one or more products, each of which is made in accordance with a certain formula. If the formula is good and the proper manufacturing method is used, then the finished product should be satisfactory. In choosing a formula, it must be considered that it may be good in one climate and country and may be unsatisfactory in another. A lipstick, for instance, may be excellent for the northern part of the United States or Canada but may soften when used in the southern part of the United States or Central and South America. The formula, therefore, would have to be changed to yield a product that does not soften at higher temperatures.

Once a formula is selected, it has to be tried out to see how it works. The first trial may not be quite satisfactory, yet the formula is good. The reason for the poor results may be that the raw material used is not sufficiently pure, e.g., using crude instead of a refined beeswax may lead to a discolored cream. A variation in temperature, such as overheating paraffin wax in a wax-paper-coating composition, will cause

decomposition and discoloration which are undesirable. There are many other factors that must be watched to produce and safeguard a product, e.g. heating time, mixing time, speed of mixing, cleanliness of the apparatus, etc.

No variation in the ingredients, quantities or methods should be made until the original formula is mastered. Then, if necessary, changes may be tried, but only one factor at a time should be varied. In case the desired effect is not obtained, the failure may be ascribed to the one specific variation that was made.

Progress should be made slowly. It is advisable to start with small batches to reduce waste of materials in case a batch is spoiled. First make the smallest possible batch, either 1 or 2 ounces, then 1/2 pound. After this, a 2-pound batch may be tried. By this time, you should be skilled enough to make larger batches.

Proper attention should be paid to the vessels used in compounding. They should not be corroded by the substances with which they come in contact. This precaution is necessary not only to prevent the vessels from being ruined but also to prevent the product from being contaminated with metallic salts.

To obtain a good product, it is necessary to test the raw materials and the finished product. The raw materials should be bought from a reliable supplier who gives a guarantee that the product he supplies is uniform and always the same. If there is any doubt concerning the purity or uniformity of the raw material, it should be tested before use. For the finished product, tests should be worked out to make sure that the consumer always gets the same preparation of suitable quality. These tests need not be elaborate. Usually it is sufficient to control the color, odor, thickness, hardness, etc.

It is not enough that a product is thoroughly tested in the laboratory before marketing, because the final judge is the user. A product should be tested by as many representative prospective buyers as possible. To make the test fair, submit a number of competitive products with one or more grades of your products for test by many different types of individuals. These testing samples should be packed in plain, uniform containers so that the person using them will not know which is which. Of course, all containers should be labeled with a number or letter so you can identify them. Keep a record of results and if your product does not appeal to the majority, then it

will not be wise to manufacture and market it. Modification and new consumer testing will then be indicated.

Once the product is manufactured, it is vital to choose the proper packaging. This is necessary not only to protect the product while stored or during its life, but also to make it attractive-looking to the consumer.

When the product is all ready for sale, a market should be prepared for it. With limited capital much publicity cannot be made but judicious small-scale advertising circulars, signs, etc. may be very helpful. At the beginning, you may have to act as a demonstrator, salesman and delivery man as well as a manufacturer. Those who are not suited for such varied and energetic activity should not consider building up a specialty business.

Now let us consider some of the products that are especially suited to build up a small profitable business.

I Compounding Chemistry

DEFINITIONS

Mixtures

A mixture is the uniform distribution of two or more substances in one another, such as a mixture of fine sand and powdered soap, or salt and sugar, or water and glycerin. The ingredients of a mixture are not chemically altered. They are the same at the end of mixing as in the beginning. Each ingredient can be removed in its original form. A good mixture, however, should have a uniform appearance. Though no chemical reaction takes place in making a mixture, very good specialties can be obtained by simple mixing.

Solution

A solution is a clear liquid obtained by dissolving a solid or semi-solid substance or a gas in a solvent. The solvent may be water, alcohol, oil, etc. A solution results, for example, when sugar is dissolved in water, or camphor in alcohol.

Suspension

A suspension is formed when a powdered substance is mixed with a liquid in such a way that the particles are suspended in the liquid without settling. A suspension can be made, for instance, by putting some bentonite (a type of clay) in water, letting it soak, and then shaking or stirring vigorously.

Emulsion

An emulsion is an intimate uniform mixture of two ordinarily immiscible liquids, e.g. oil and water. By using a special agent called an emulsifying agent, the liquids are dispersed in each other so finely that the mixture has a uniform milky appearance. So long as an emulsion is stable, the two liquids do not separate in layers. An emulsion, for example, results when water, mineral oil, and a strong soap solution are

shaken vigorously. The strong soap solution acts as an emulsifying agent.

Chemical Compounds

In all previously discussed products, the ingredients did not react chemically with one another. In a real chemical compound, the ingredients are chemically combined with one another. The new compound may be entirely different in appearance and action from the original substances used. The original ingredients are changed in the chemical compound and can only be recovered by another chemical reaction. The following is an example of the formation of a chemical compound: Caustic soda and cottonseed oil are mixed together and heated. A chemical reaction takes place with the formation of soap and glycerin. Both soap and glycerin are products entirely different from cottonseed oil and caustic soda.

Every chemical is unique in its chemical and physical properties. Therefore no chemical can replace another in all its characteristics. In the following, general information is given on the properties of chemicals.

PHYSICAL PROPERTIES OF CHEMICALS

Form

Substances occur or are produced as gases, liquids or solids. These are always the same under the same conditions of temperature and pressure. Gases and liquids usually do not exhibit any variation in appearance, handling or use under similar conditions. Solids, however, do differ and may cause trouble. If they are crystals, the crystals may be large or small. The same substance may have different crystalline forms (needle-like, cubical, etc.), appearance, or bulking properties. The crystals may lose water and change into a dry powder. Powders consist of particles which may vary in size. Such variations not only affect appearance but also density, flow, agglomerating or caking tendencies, suspension, deposition, friction and other properties.

Optical Properties

Color
Clarity
Fluorescence
Phosphorescence
Iridescence

Refractive Index
Reflectance
  dull
  shiny

Color is of importance not only for appearance, but also where staining, dyeing or pigmentation will occur. The color of a substance may vary with the size of the particles. Crystalline copper sulfate is deep blue while the finely powdered material is a very light blue. Certain substances lose or change their color on being dissolved, dehydrated or on interaction with another ingredient.

Clarity refers to clearness and freedom from haze or turbidity. Sometimes commercial products which should be clear develop a haze, turbidity, deposit or a sediment, especially in metal containers. They may lose clarity even in glass containers, e.g., formaldehyde.

Odor

Pleasant
Unpleasant
Strong
Faint
Temporary
Permanent

Odor is the effect on the sense of smell produced by particles emanating from a substance. In many products such as foods, cosmetics and household articles, odor is an important factor. Where an undesirable odor cannot be eliminated, it may often be covered up by a stronger, more desirable odor.

No odor is equally pleasing to all. Certain types of pleasant odors are bland, refreshing or stimulating and are not objectionable in certain products. Unpleasant odors may be sickening, irritating or depressing. An odor may be strong or faint. Faint unpleasant odors are more tolerable than strong unpleasant odors and may be masked more easily.

Very volatile odors may only be temporary and may disappear quickly on aging, storage or use. Permanent odors must be considered as an ever present factor.

In blending various materials there may be a diminution of odor, caused by the dilution or change in character or strength of the substance. These changes may result from decomposition or interaction with another ingredient.

Taste

Sweet
Sour
Bitter
Salty
Spicy
Oily
Fruity
Neutral or tasteless
Pleasant
Unpleasant
Strong
Permanent

Taste is a factor of importance in those products that enter the mouth. Such products are foods, beverages, medicines, dentifrices and certain cosmetics for the lips.

Pleasant tastes may be sweet (as in sweet chocolate); sour (as in lemon drops); bitter (as in hops, used in beer making); spicy (as in ginger); salty (as in brine); oily (as in olive oil); neutral or tasteless (as in water); fruity (as in berries).

Just as with odors, strength and permanence are of importance, and must be given due regard. An undesirable taste may often be covered up by a stronger or more desirable taste. Certain tastes that are unpleasant when too strong are more pleasant when diluted, e.g. saccharin.

Density and Specific Gravity

Density is the weight per unit volume, e.g. pounds per cubic foot. Specific gravity is the relation between the weight of a given substance with the weight of an equal volume of water at the same temperature.

The density or specific gravity of a product will vary with its purity, porosity, size of its particles, and the process by which it was made.

Density or specific gravity are critical factors where bulking value, suspension, low cost, etc., are important. Thus calcium carbonate will vary in density or specific gravity, depending on whether it is in the form of natural limestone, marble, chalk, or a chemically precipitated product.

Viscosity

Viscosity is the resistance of a fluid to shear, agitation or flow,

More commonly, it is a measure of the rate of flow of a specific liquid as compared to that of water or any other commonly used liquid.

In some cases, viscosity is of importance because the greater the viscosity of a liquid, the lower the rate of flow, spreading, penetration, wetting, etc. and the better its suspending power. A lower viscosity, of course, reverses these properties. A viscous liquid is harder to mix, fill, pour and apply than a less viscous liquid.

Viscosity may be increased or lowered by suitable additions and treatments. Thus the viscosity of mineral oil can be increased by heating it with some aluminum stearate; the viscosity of an alkaline casein dispersion can be reduced by means of urea. Other specific methods for altering viscosity are known and these should be used when a substitute is suitable in all other respects.

Gelling or Thixotropic Tendencies

Gelling is the formation of a gel or jelly-like substance, e.g. glue or agar with water.

The thixotropic state refers to a gel that liquefies on shaking or stirring and regels on standing, e.g. iron hydroxide or certain clay suspensions in water.

Gelling may be desired in certain cases as in hectograph (duplicating) compositions, whereas in the case of a paint, gelling, which would prevent brushing or spraying, is undesirable.

Gelling may be due to the colloidal properties of a single substance in a liquid (as with gelatin and water) or may result from the interaction of one or more substances (as with sodium silicate and dilute hydrochloric acid).

Gelling may be temporary, as in the case of a cold gelatin and water jelly which becomes liquid on warming, or it may be more or less permanent, as in the case of rubber cement (rubber swollen in a hydrocarbon solvent).

Gels may be thinned or prevented from forming by the addition of suitable agents. Thus fish glue, in water, is prevented from jelling by the addition of acetic acid.

Freezing Point and Melting Point

The freezing point is the temperature at which a liquid solidifies or begins to form crystals under normal conditions. Liquids containing impurities or added substances have different freezing points than the pure liquids. Therefore, the freezing point of a liquid is a measure of its

purity. If the freezing point of a substance is too high or too low, it may be altered by suitable additions.

The melting point is that temperature at which a solid changes to a liquid, under normal conditions.

Some mixtures, e.g. hydrogenated coconut oil, do not have a definite melting point but melt over a specific temperature range. Other substances soften or become plastic at certain temperatures, e.g. pitch, cellulose acetate, etc. Still others do not melt but sublime when heated sufficiently.

Vapor Pressure

Vapor pressure is the pressure of any vapor above its liquid or solid form. The greater the vapor pressure of a substance, the greater is its tendency to evaporate when exposed. High vapor pressure is desired in products which are expected to evaporate or dry quickly, as in cleaning fluids and lacquer thinners. Low vapor pressures are desired in product that should not change in bulk or dry out, as in flexibilizers for glue, casein, etc. or plasticizers for lacquers or plastics.

Sublimation

Sublimation is the direct vaporization of a solid that does not first liquefy, e.g. camphor or naphthalene.

Substances that sublime are useful when volatilization at certain temperatures is desired. Certain substances (camphor and naphthalene) sublime at ordinary temperatures. Of course, this means that they will gradually disappear when exposed. Where such volatilization is undesirable, subliming substances should not be used.

Boiling Point

The boiling point is the temperature at which the vapor pressure of a liquid equals the atmospheric pressure. Pure liquids have a definite boiling point. Commercial products, which contain impurities, boil over a range of temperatures, which is known as the boiling range. Thus pure water boils at 100°C at 760 mm pressure. Commercial methyl oleate boils at 200 to 215° C at 15 mm pressure.

Low-boiling liquids volatilize readily and disappear. This, of course, is advantageous where quick drying is necessary, as in the case of rubber cement or hair lacquers. High-boiling liquids are specified where volatility is to be kept at a minimum to prevent drying out, brittleness, shrinkage, etc. as in the use of glycerin in Cellophane or castor oil in ethyl cellulose.

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