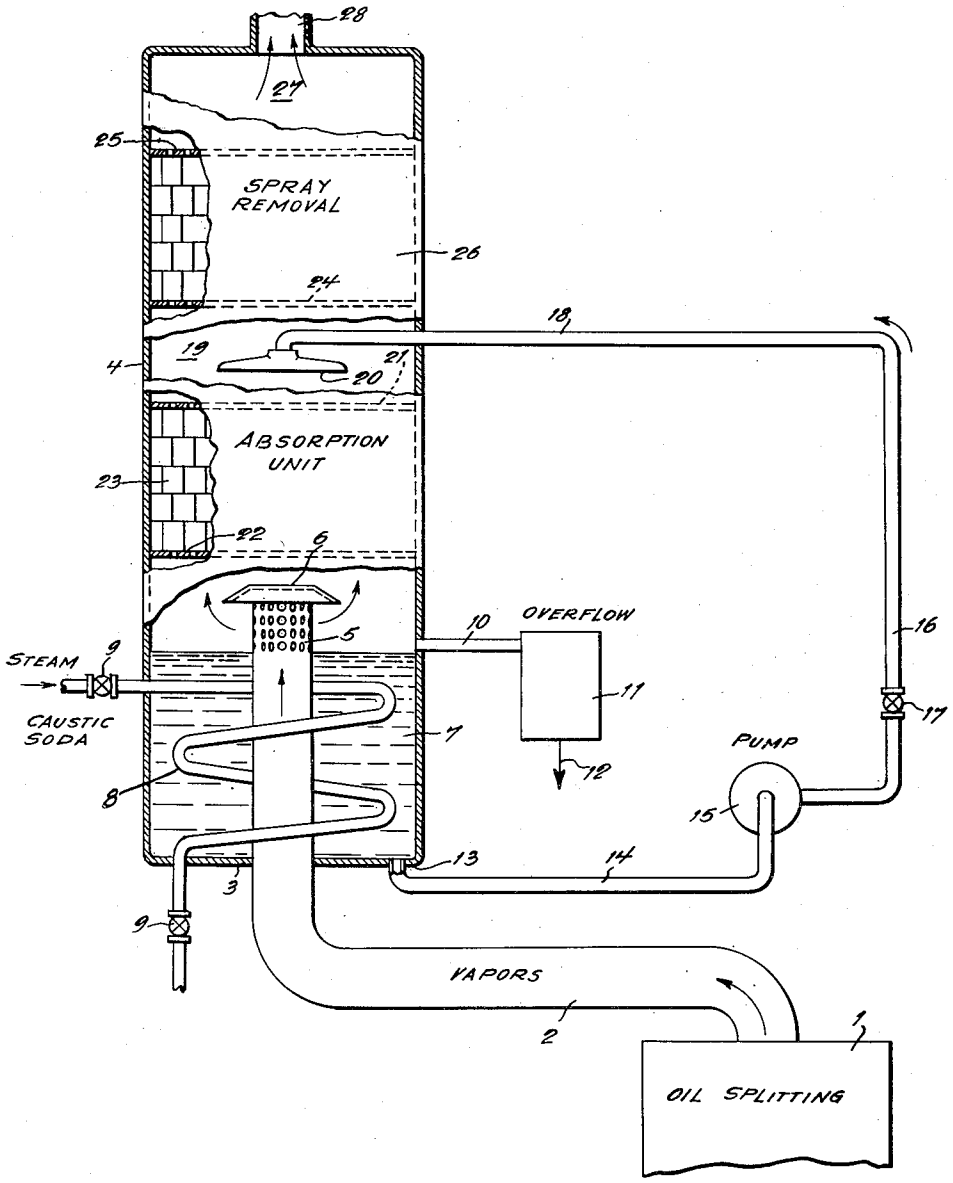
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APPARATUS FOR RECOVERING VOLATILE MATERIALS

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APPARATUS FOR RECOVERING VOLATILE MATERIALS

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4 Claims. (Cl. 23—283)

1

The present invention is directed to oils and fats and more particularly to an apparatus for the treatment of waste and objectionable vapors emanating from the splitting of such oils and fats for the production of free fatty acids. The application is a division of copending application Serial No. 612,275 filed August 23, 1945, entitled "Method of Recovering Volatile Materials," now Patent No. 2,471,942.

In said application the prior art was discussed in which it has been common practice to treat vegetable and other oils and fats which are glycerides of mixed higher fatty acids in order to hydrolyze the same and to split the fatty acids from the glycerine. This has been accomplished by the use of such splitting agents as mineral acids, Twitchell reagent and the like, under the application of heat and sometimes of pressure. Such processes give rise to vapors having undesirable and often disagreeable odors which in many cases presented a great nuisance to the surrounding community if such vapors were allowed to escape during the process. Such vapors include in most cases, in addition to the disagreeable odors, vapors of water, mineral acid, fatty acid and glycerine. Some of the vapors may be derived from the sulphonating or splitting agent used in the process.

Attempts have been made to prevent the diffusion of such vapors into the outside air both to abate the nuisance caused by such vapors in a community and to prevent the unnecessary loss of valuable ingredients in said vapors. However, efforts to economically recover such vapors have heretofore not met with success.

The present invention is intended to overcome such difficulties and has among its objects the provision of an apparatus for the treatment of such vapors whereby they may be absorbed and the objectionable odors eliminated.

It is also among the objects of the present invention to provide a treatment of vapors given off in the hydrolysis of fats and oils whereby the fatty acids contained in such vapors may be economically recovered.

It is still further among the objects of the present invention to provide a means for fractionating the fatty acids of certain oils and fats whereby a mixture of lower fatty acids contained in such oils may be recovered.

In practicing the present invention, there is provided an absorption tower into which the waste vapors are led and allowed to pass upwardly through the same. In the center of the tower is an absorption unit having a solution

2

of caustic soda passing downwardly counter-current to the upwardly traveling vapors. A body of caustic alkali solution is maintained in the bottom of the tower with a pump or the like for circulating the same over the absorption unit. The cycle of treatment is maintained until a certain concentration of fatty acid has been absorbed in the caustic alkali in the form of soap. Usually from 4 to 5% of fatty acid in the solution is considered sufficient to enable economical recovery of the fatty acid from the solution. It is desirable to have a minimum concentration of caustic alkali in the solution of about 2% in order to avoid interference by foaming of the soap in the solution. It is also important that the solution being circulated be kept at a relatively high temperature, usually in the neighborhood of the boiling point of water in order that there shall be a minimum of absorption of water vapor from the mixed vapors being treated. This contributes greatly to the effectiveness of the operation.

Such a process enables the recovery of substantially all of the fatty acids which may be present in the vapors and the absorption is in such a form that the fatty acids may be readily recovered therefrom. Simultaneously therewith, the objectionable odors present in the vapors are also absorbed and are eliminated from the atmosphere. When such oils as the coconut type of oil is treated, the vapors thereof contain the lower fraction of the fatty acids present in the original oil and the absorption of such fatty acids from the vapors is capable of providing the mixed lower fatty acids, which as a unit are eminently suitable for adaptation in commerce, as for example, in the form of the polyalkylene glycols for use as plasticizers.

In the accompanying drawing constituting a part hereof and in which like reference characters indicate like parts, the single figure is a vertical cross-sectional view taken through an apparatus made in accordance with the present application, some parts being shown in elevation and other parts being shown diagrammatically.

In the treating vessel 1, there is performed the operation of splitting the oil or fat by any of the usual reagents. The vapors produced in the process pass through duct or pipe 2 which extends vertically upward through the central part of the bottom 3 of a vertical tower 4. The upper end 5 of duct 2 is provided with a series of openings to allow the vapors to escape into the tower. A cap 6 is provided at the top of pipe 2 to prevent accidental entrance of solution into the same.

In the bottom of the tower is a body 7 of caustic soda solution. The amount of caustic soda present is usually not less than 2% and may be as much as 35%. A coil 8 surrounds pipe 2 and is provided with valves 9 whereby the flow of steam or other heating agent may be controlled to maintain the desired temperature in the solution. Usually a temperature of 210 to 215° F. is so maintained. A pipe 10 extending from tower 4 is at a level just below openings 5. When the solution in the tank becomes too high, the liquid passes through pipe 10 into overflow chamber 11 and out through 12 for re-use.

In the bottom 3 of the tower which slopes slightly and at the lowest point thereof, there is an exit opening 13 and a pipe 14 leading to pump 15. A pipe 16 from the pump has a check valve 17 therein, said pipe extending upwardly and then horizontally as shown at 18, passing into the tower at an intermediate point thereof into space 19. A spray head 20 is adapted to disseminate liquid into the tower. Between horizontal perforated plates 21 and 22 is an absorption unit 23 of any suitable type, such as the well-known Raschig rings, suitably packed in order to cause liquid to pass downwardly over the surfaces in contact with the vapors passing upwardly in the unit.

Above the spray 20 are a pair of similar horizontal perforated plates 24 and 25 having between the same a packing or filling 26 which may also be of Raschig rings. The spent gases and vapors after passage through the unit 26 enter upper end 27 of the tower and pass out therefrom through opening or stack 28.

In the operation of the apparatus for the treatment of the waste vapors, the caustic soda solution is maintained at about the boiling point of water and is continuously circulated by pump 17. Vapors are allowed to pass through the duct 2 out of openings 5 and upwardly through absorption unit 23. The vapors come into intimate contact with the hot caustic soda solution whereby all acid vapors are absorbed and recovered from the vapors. Because of the high temperature of the solution, very little, if any, water vapor is absorbed therein and it passes up out of the absorption unit with other unabsorbed substances. The circulation of the liquid is continued, causing a gradual building up in the solution of fatty acid soaps. When the fatty acid content reaches 4 to 5% or higher and the caustic soda content is down to about 2%, the solution may be removed for the recovery of the fatty acids. A fresh caustic soda solution is introduced and the cycle is continued.

Due to the fine sub-division of the solution as it is sprayed from the spray head into the tower, and the upwardly flowing current of gases and vapors, some of the solution may be carried along with the same. Therefore, the spray removal unit 26 is provided, which catches the spray on the packing material and the solution flows downwardly and eventually reaches the absorption unit. The temperature of the spray removal unit is also preferably maintained at about the boiling point of water so as not to dilute the solution. Therefore, the gases passing out through stack 28 contain substantially all of the water vapor which had been present in the vapors in duct 2.

The solution containing the soaps may then be acidulated as by the use of sulphuric acid in the usual manner to split the soap stock. The resulting product contains at least 99% of fatty

acids and they may be used as such or be redistilled or otherwise treated for further purification.

The present invention is adapted for use in all cases where fats and oils of a glyceride fatty acid type are split to recover fatty acids. The invention is particularly adapted for use where the coconut type of oil is split. Such oils contain a substantial amount of lower fatty acids having 6, 8, 10, 12 and 14 carbon atoms in addition to the fatty acids of 16 and 18 carbon atoms which are present in practically all vegetable and animal oils. It has been found that the vapors produced in the splitting of, say, coconut oil, contain only the lower fatty acids present in such oil having from 6 to 12 carbon atoms. When such a mixture of fatty acids is recovered first in the form of soap and then in the form of the mixture of free fatty acids, the approximate composition thereof is as follows:

	Per cent
Caproic (C_6)	15.9
Caprylic (C_8)	56.8
Capric (C_{10})	19.4
Lauric+etc. (C_{12+})	7.9

Therefore, the present invention provides a simple and inexpensive means for fractionating the fatty acids of coconut oil to recover a mixture of lower fatty acids. These have been found eminently suitable for use as the mixed polyethylene glycol esters, as plasticizers for various resinous materials, synthetic rubber and the like.

Although the invention has been described by use of a certain specific example, the invention is not limited thereto as various modifications in the process and the apparatus may be made within the scope of the invention. For instance, the caustic soda solution may be used until the concentration of the fatty acid is greater than that specified herein, or the caustic soda content thereof may be replenished continuously or intermittently. Also, the process may be operated so that a part of the caustic soda is withdrawn for the recovery of fatty acids and the volume replenished by fresh caustic soda solution. Other alkalis than sodium hydroxide may, of course, be used in the process. The minimum concentration of alkali may be less than 2% in some cases.

The absorption units may be of different character and under suitable conditions the units may be entirely omitted where the tower is sufficiently high and the absorption of the fatty acids and objectionable odors is sufficiently complete without the necessity of packing in the tower. The tower need not be made in a single vertical unit but one or more of the elements such as the container, absorption unit and spray removal unit may be made separately and suitably coupled together. Such units may be placed in a vertical position or they may be horizontally displaced. In place of steam, other means may be used for maintaining the desired temperature of the circulating solution.

The invention is applicable not only to vapors resulting from the splitting of oils and fats, but also to vapors arising from various other operations on glyceride oils, fats, fatty acids, soap stock, and others, wherein the vapors contain acid constituents, water vapor and objectionable odors.

These and other changes in the details of the practice of the invention may be made without departing from the spirit thereof and the invention is to be broadly construed and not to be

limited except by the spirit of the claims appended hereto.

I claim:

1. An apparatus for treating waste gases and vapors from the hydrolysis of oils and fats comprising a set of three vertically disposed chambers constituting a single tower, perforated plates between said chambers, an inlet pipe for said vapors extending centrally through the bottom of the lowest chamber and terminating at the top thereof, the top of said pipe having perforations in its sides and a cap on the upper end thereof, a spray head in the top of the intermediate chamber and packing material in the lower part thereof, a pipe connection from said spray head to the bottom of said lowest chamber, an overflow pipe in the upper part of said lowest chamber adapted to draw off liquid from a point just below said perforations, distance between said overflow pipe and the bottom of said lowest chamber adapted to permit a deep body of liquid to be maintained therein, the area of said inlet pipe submerged in said liquid being sufficient to provide material heat exchange with said liquid, a heating coil for maintaining said body at about the boiling point of water surrounding said inlet pipe below said overflow pipe, packing material in the uppermost chamber, and an exit stack centrally of the top of said uppermost chamber.

2. An apparatus for treating waste gases and vapors from the hydrolysis of oils and fats comprising a set of three vertically disposed chambers constituting a single tower, perforated plates between said chambers, an inlet pipe for said vapors extending centrally through the bottom of the lowest chamber and terminating at the top thereof, the top of said pipe having perforations in its sides and a cap on the upper end thereof, a spray head in the top of the intermediate chamber and packing material in the lower part thereof, a pipe connection from said spray head to the bottom of said lowest chamber, a pump in said connection for causing liquid to flow through said spray head, an overflow pipe in the upper part of said lowest chamber adapted to draw off liquid from a point just below said perforations, distance between said overflow pipe and the bottom of said lowest chamber adapted to permit a deep body of liquid to be maintained therein, the area of said inlet pipe submerged in said liquid being sufficient to provide material heat exchange with said liquid, a heating coil for maintaining said body at about the boiling point of water surrounding said inlet pipe below said overflow pipe, packing material in the uppermost chamber, and an exit stack centrally of the top of said uppermost chamber.

3. An apparatus for treating waste gases and vapors from the hydrolysis of oils and fats comprising a set of three vertically disposed chambers constituting a single tower, perforated plates between said chambers, an inlet pipe for said vapors extending centrally through the bottom of the lowest chamber and terminating at the top thereof, the top of said pipe having perforations in its sides and a cap on the upper end thereof, a spray head in the top of the intermediate chamber and packing material in the lower part thereof, the space surrounding said spray head being free from packing material, a pipe connection from said spray head to the bottom of said lowest chamber, an overflow pipe in the upper part of said lowest chamber adapted to draw off liquid from a point just below said perforations, distance between said overflow pipe and the bottom of said lowest chamber adapted to permit a deep body of liquid to be maintained therein, the area of said inlet pipe submerged in said liquid being sufficient to provide material heat exchange with said liquid, a heating coil for maintaining said body at about the boiling point of water surrounding said inlet pipe below said overflow pipe, packing material in the uppermost chamber, and an exit stack centrally of the top of said uppermost chamber.

4. An apparatus for treating waste gases and vapors from the hydrolysis of oils and fats comprising a set of three vertically disposed chambers constituting a single tower, perforated plates between said chambers, an inlet pipe for said vapors extending centrally through the bottom of the lowest chamber and terminating at the top thereof, the top of said pipe having perforations in its sides and a cap on the upper end thereof and a cap thereon, a spray head in the top of the intermediate chamber and packing material in the lower part thereof, a pipe connection from said spray head to the bottom of said lowest chamber, an overflow pipe in the upper part of said lowest chamber adapted to draw off liquid from a point just below said perforations, distance between said overflow pipe and the bottom of said lowest chamber adapted to permit a deep body of liquid to be maintained therein, the area of said inlet pipe submerged in said liquid being sufficient to provide material heat exchange with said liquid, a heating coil for maintaining said body at about the boiling point of water surrounding said inlet pipe below said overflow pipe, packing material in the uppermost chamber, and an exit stack centrally of the top of said uppermost chamber.

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