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# Soap-making

The Purification of Oils and Fats and the  
Utilization of the Last Traces of  
Alkali of the Spent Lye

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## Soap-making:

### The Purification of Oils and Fats and the Utilization of the Last Traces of Alkali of the Spent Lye.

There are in India not a few indigenous oils and fats of a vegetable origin which possess good soap-making properties but cannot be made use of in the soap industry for the production of a good soap. The reason is that these oils and fats contain varying proportions of colouring and odorous matters and, frequently, organic mucilageous matter. These impurities must be removed to the greatest possible extent if a really good soap is to be made consistently with the general quality of the raw material.

2. The organic mucilageous matter is derived from the seed during the expression of the oil and remains in the oil in a fine state of division, giving it a cloudy appearance. The mucilageous matter may not have any colour of its own, but when brought in contact with caustic soda lye in the hot state, as in the soap pan, it is readily acted upon and frequently produces colours from which the resulting soap cannot be freed. It will be seen, therefore, that the soap will be of an inferior quality when made from such oil than when made from the same oil after the removal of the mucilageous matter. A simple process for the removal of the mucilageous matter has been devised and found satisfactory. The process, as described later, consists of the treatment of the impure oil with boiling water, followed by the settling of the impurities on standing. It leaves the oil free from all mucilageous matter and their harmful effects.

3. The most obstinate impurities are, however, the colour and the odour, and these appear to remain dissolved in the oil, and sometimes in their own vehicles, and cannot readily be got rid of in a simple way. Their elimination, partial or total, cannot be effected without chemical means. Drastic chemical treatments cannot, however, be resorted to for the reason that while removing the impurities in those cases in which removal is possible, they also destroy the natural protective element of the oil and lay it bare to the development of rancidity from the effects of which the soap made from the oil cannot enjoy immunity. After an exhaustive search for a suitable process for purification, so far as the requirements of the washing soap industry are concerned, a method has been devised which consists only of a slight modification, as described later on, of the process of soap boiling without involving any separate treatment of the oil, and meets the end in view.

4. The processes of purification are described below:—

#### Water Purification.

The oil or fat to be purified is to be taken in a round-bottomed iron pan of a size suitable for the quantity of stock to be dealt with, the oil or fat filling up to nearly half the pan. Water of a volume equal to that of the oil should then be run into the pan. The little empty space left

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in the pan will be enough for the boiling, as there will be no fear of the contents swelling up like soap. The oil or fat, being lighter, floats on the water. The contents of the pan are next boiled for one to two hours depending on the quantity of impurities present in the original oil or fat. No harm is done by heating the pan over direct fire, because the oil forms the upper layer and never comes in contact with the bottom of the pan. In some cases, however, a little froth is noticed. The boiling should in such cases be continued until the froth disappears. It is essential that a state of brisk boiling be maintained during the process. The agitation of the contents caused by ebullition is more helpful than any mechanical stirring device in bringing all the oil and water in repeated close contacts. The treatment leaves the oil in a condition in which it can quickly settle the impurities. On the conclusion of boiling, the pan is left undisturbed for a sufficiently long time to allow of proper settling of impurities. The clear oil collects at the top and all the mucilageous matter is found collected in a layer of emulsified oil between the clear oil and the water. After the settling of the impurities, the supernatant clear oil is taken off, either by means of cocks or by pumping off, leaving the layer of emulsified oil for further treatment as described later on. If the oil has a chance to solidify on cooling, it has to be removed while still hot, or it may be allowed to solidify and the impurities that will be found in the bottom side scraped off.

5. The thickness of the emulsified layer depends on the nature of the oil. With a saturated oil the emulsification is little or nil and the oil separates very readily, while it is not so in the case of an unsaturated oil. The iodine value, *i.e.*, the amount of iodine absorbed by an oil or fat, is a measure of its unsaturation, the more unsaturated oils having higher iodine values and vice versa. Coconut oil and tallow, for example, which have very low iodine values and are hence fairly saturated, do not, for all practical purposes, emulsify, while linseed oil, owing to its very high iodine value and consequent unsaturation, emulsifies very readily. Mowha and Karanja oils have, in accordance with their respective iodine values, intermediate emulsifying powers, the latter, as expected, surpassing the former.

6. Oils which emulsify readily take long to separate into oil and water again. When, therefore, such oils are treated according to the method just described, considerable quantities of the oil are held by the emulsion from which it separates out only very slowly. The purification process is thus made a very lengthy one in the case of the above oils, and it is therefore not advisable to treat them singly. In admixture with low-emulsifying oils, however, they have been found to separate readily. It is therefore recommended that the soft oils, *i.e.*, oils with high iodine values, should, for the purpose of purification, be mixed with hard oils, or fats with low iodine values.

7. The emulsified layer, containing the mucilageous and other light impurities, is filtered through cloth. The filtrate consisting of a clean mixture of oil and water is added to the next charge, the impurities being separated and retained by the filtering cloth. It will thus be seen that no oil need be wasted in the process of refining, the impurities being the only thing eliminated.

8. The purification of the oil by the above process should be undertaken as and when the oil is required for saponification. If much time is allowed to elapse between the purification and the saponification, the

purified oil may develop a fresh objectionable odour without redeveloping colour.

9. Practical application of the above method of refining was made in the case of tallow containing fleshy and other impurities.\* Although it effectively removes all floating and mucilageous impurities, it does not generally remove the odour and colour of the oil, except to a small extent by the action of water and the effects of boiling.

### Purification over Spent Lye.

10. For oils which have a bad odour with or without an objectionable colour, the course of treatment with boiling water is not, as already stated, enough. Some of the more volatile constituents of the odour are, it is true, carried off by the steam in course of the boiling, but the stabler ones are not dislodged. The hold of the vehicle on the odorous matter as a whole, or at least a very substantial part of it, must be loosened—a task to which boiling water alone has not been found equal. To achieve the object in view, the oil or fat is to be boiled over the spent liquor obtained on salting a pan. It is essential that the spent liquor should contain enough salt to prevent the stock to be purified from forming an emulsion with the lye, or the dissolving, in the latter, of any soap which is formed as a result of the partial saponification of the stock with the caustic soda present in the spent lye. This process removes the odour to a great extent, unless the same is present in an excessive amount in which case a more rigorous treatment will be necessary. It will thus be seen that during the process the small quantities of the caustic usually present in the spent lye is utilized in saponifying a portion of the oil, the purified product being directly mixed with the main soap charge.

11. When there are much odorous and colouring matters present in the stock, it is to be purified separately before going to form any mixture and the purification process is to be pushed to the extreme by eventually saponifying the stock. By such treatment alone can all the colouring and odorous matters in the oil be effectively removed, unless they are present as independently coloured resinous or similar bodies which pass through the transformation into soap with their original colours. An example of the latter case is punnal oil, the colour of which is due to a coloured resin.

12. When the stock to be purified is of the above description, that is to say, contains much odorous and colouring matters associated with resinous bodies, the simple boiling over spent lye containing a little free caustic soda will not meet the end. Examples of such cases are neem oil and grease from bones. In such cases it is not possible to have refined oils, for the treatment required amounts to saponification of the stocks in order to deprive the odour and colour of their vehicles, the final product being soap free from the defects due to odour and colour. The following procedure is to be adopted in these cases. The stock is to be added to the spent lye and boiled to nearly complete saponification. This necessitates the addition to the spent lye of just enough oil or fat which can be saponified by the free alkali present in it. It is sometimes an advantage to supplement the caustic originally present

\*Vide this Department Bulletins No. 30 (English) and No. 40 (Bengali).

in the spent lye with fresh caustic to get through a larger quantity of oils and fats and to utilize the lye medium for the elimination of as much colouring and odorous matters as possible. When the saponification proceeds over the spent lye, the oil medium carrying the odorous and colouring matters is converted into soap with the result that the colouring matter is disengaged and discharged into the lye and the odorous matter escapes along with the steam. The oil thus purified, and converted into soap is next added to the main soap charge for the production of high grade soaps consistently with the general quality of the raw material and without any of the disabilities due to the colouring and odorous matters.

13. As the process entails the boiling of large quantities of lye for the treatment of limited quantities of soap stock, the operation is best carried on economically in shallow pans over the flues of regular soap-boiling furnaces. It will be seen that the heat that is usually wasted will be utilized in the recovery of all the caustic soda in the spent lye and at the same time in purifying, or treating up to saponification, very inferior stocks and making them suitable for good quality soaps.

14. To sum up the results, the purification over water is necessary if the oil contains much floating mucilageous organic matter. This is to be followed by a spent lye boiling if the colouring and odorous matters are not of much intensity. When, however, these are very intense, almost complete saponification over spent lye will secure their removal except in those cases in which some resinous constituent of the stock is itself coloured. The very inferior stocks must be treated separately for purification before putting to the soap charge. These steps will ensure the production, otherwise impossible, of high quality soaps from inferior stocks.

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