A Critical Study of the Refining of Rice Bran Oil

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Rice bran oil can become a major edible oil in India, provided the various problems can be eliminated. These are high unsaponifiable matter including waxes, high free fatty acids (FFA) and dark color in many extracted rice bran oil samples. There are many ways to purify commercial rice bran oil which still need critical investigations in the Indian context so that the technology becomes available to enhance production of rice bran oil for domestic consumption and vanaspati production.

The degumming agents, e.g., water, phosphoric acid, citric acid and some commercial nonionic surface active compounds, have been investigated. The extent of degumming, color removal, unsaponifiable matter and process loss indicates that nonionic surface active compounds are more suitable as degumming agents when used between 0.5 and 1% and dissolved in 2-3% water on weight of oil. The degumming process includes mixing the oil at 80 C with the various agents for 15 min.

The degummed oil has been subjected to dewaxing treatment which involves chilling at a low temperature (10-20 C) in the presence of suitable surface active compounds used between 0.5 and 2% on the weight of oil in either concentrated form or in solution in water while maintaining a slow stirring for 2-4 hr. The chilled mass is then centrifuged when the wax that is crystallized is removed; the oil obtained is clear and practically wax free.

The degummed and dewaxed oil is then neutralized with an appropriate strength of alkali solution using sufficient excess at 50-60 C by mixing for 10-15 min under a fairly high stirring rate. The mass is then centrifuged at 8000 rpm and the oil is rigorously washed with hot water and centrifuged to remove traces of soap. The neutralized oil is dried and bleached at different temperature and with varying proportions of earth and activated carbon. The bleaching efficiency in terms of color removal has been found to depend on a certain temperature range which lies between 110 and 120 C.

This process can be adopted in India for purifying for edible consumption, commercial rice bran oil having 4-10% FFA.

High FFA rice bran oil (15-20%) has been very effectively deacidified when the degummed, dewaxed and prebleached oil is heated with superheated steam at 240-260 C at ca. 10-12 mm Hg absolute pressure. It has been observed in this deacidification process that there is a fixation of color which becomes highly resistant to bleaching, even by using very active acid treated earths.

Rice bran having 15-20% FFA oil after degumming and dewaxing can be quite effectively deacidified to ca. 4-5% after two-stage extraction and to ca. 2% by three-stage extraction at ambient temperature (30-33 C) when oil and alcohol are mixed by stirring. The partially deacidified oil when subsequently alkali refined and bleached produces a satisfactory light color oil suitable for edible uses.

Miscella dewaxing has been investigated with respect to oil content in the miscella, crystallization temperature and crystallization time. When the miscella contains 45-60% oil in hexane and the crystallization temperature is ca. 3-5 C, the bulk of the wax is removed after 12-18 hr. The oil after the removal of the solvent is subjected to the usual degumming, neutralization and bleaching. The purified oil obtained is also acceptable for consumption as edible oil.

Degummed and dewaxed rice bran oil has also been deacidified by reesterification with added glycerol in different proportions with and without catalyst system at temperatures of 180-220 C, with 20% excess glycerol in the presence of 0.2-5% paratoluene sulphonic acid under inert atmosphere. FFA have been reduced readily from 15 to 4% in ca. 6 hr. However, again there is a fixation of color which cannot be significantly reduced by further alkali neutralization and bleaching.

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