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Effect of metal ions on the oxidative stability of coconut oil

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Coconut oil prepared by boiling coconut milk is more resistant to oxidation compared to coconut oil prepared by expression of copra. Iron content in coconut oil prepared by expression process (5.670 ± 0.960 ppm) is significantly higher than that in coconut oil prepared by boiling process (0.5970 ± 0.0730 ppm). Free metal ions such as Fe^{3+} are known to catalyze lipid peroxidation. As a part of our research focused on the quality improvement of coconut oil, the effect of Fe^{3+} and Cr^{3+} on the free acid and peroxide formation in coconut oil was investigated. Coconut oil prepared by boiling coconut milk with known Fe^{3+} and Cr^{3+} concentrations was used to prepare oil samples with different metal concentrations and as control. Free acidity and peroxide value of the oil samples were periodically determined by an acid-base titration and thiocyanate assay method respectively for 30 days.

The results show that Fe^{3+} and Cr^{3+}, up to 10.0 ppm with respect to each ion in coconut oil, do not significantly increase free acid formation in coconut oil with respect to a control with no added Fe^{3+} and Cr^{3+}. However, Fe^{3+} and Cr^{3+} accelerate the formation of peroxides in coconut oil. The rates of formation of peroxides in coconut oil at 2.0, 6.0, and 10.0 ppm Fe^{3+} concentrations were 0.00761 ± 0.00012, 0.03853 ± 0.00090, and 0.10656 ± 0.00576 H_2O_2 mg/mL day respectively. The rate of formation of peroxides in the control with 0.59 ppm Fe^{3+} was 0.00440 ± 0.00009 H_2O_2 mg/mL day. The effect of Cr^{3+} on the peroxide formation in coconut oil is not as pronounced as that of Fe^{3+}. The rates of formation of peroxides in coconut oil at 2.0, 6.0, and 10.0 ppm Cr^{3+} concentrations were 0.00523 ± 0.00003, 0.00745 ± 0.00002, and 0.00874 ± 0.00023 H_2O_2 mg/mL day respectively while the control with 0.004 ppm Cr^{3+} showed a rate of 0.00440 ± 0.00009 H_2O_2 mg/mL day for peroxide formation.

Long shelf life of coconut oil is especially important when coconut oil is used as an ingredient in hair oils, conditioners and other beauty products. The above results show that Fe^{3+} and Cr^{3+} that may contaminate coconut oil during the extraction decrease the oxidative stability of coconut oil. These observations also suggest that higher metal content is one factor responsible for the lower stability of coconut oil prepared by expression process.

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