Investigation on the Use of Used Polyethylene Terephthalate Bottles to Remove the Hazardous Polycyclic Aromatic Hydrocarbons from Coconut Oil

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ABSTRACT

Polycyclic Aromatic hydrocarbons (PAHs) are organic compounds containing two or more fused aromatic rings representing, a class of well known carcinogenic and /or mutagenic. In foods they are mainly formed during food processing in both commercial and domestic food preparation. PAHs in coconut oil could be brought about by direct drying of copra with smoke and during the grinding process to extract the oil. Polymers could play an important role for removal of PAHs from food, because some plastic materials can interact with PAHs. Polyethylene terephthalate (PET) polymer increasingly being used for food packaging and they also have higher affinity for PAH.

The main aim of this work was to study the possibility of removal of PAH contained in liquid media onto PET surface under different experimental conditions to achieve an optimum removal. At first step 10 ppm and 25 ppm naphthalene in water, were stored at room temperature and at 8°C in PET receptacles (surface area ≈ 150cm^2) and in PET polymer chips contained PET receptacles (surface area ≈ 450cm^2) separately. PET polymer chips were used to increase the surface area. The adsorption of PAH from sample solution to PET surface was assessed at decided time intervals using fluorimeter and UV-visible spectrophotometer. During this period the PAH concentration was lowered in each step. The reduction of PAHs is due to the adsorption of PAHs onto PET surface. Elevated temperature, concentration and surface area have improved the adsorption of PAHs from water onto PET surface. Adsorption data also indicate applicability of both first order and second order kinetic models for the adsorption process.

At second step coconut oil was spiked with 10 ppm and 25 ppm naphthalene in methanol separately and stored at room temperature in PET receptacles (surface area ≈ 150cm^2) and in PET polymer chips contained PET receptacles (surface area ≈ 450cm^2) separately. Adsorption of PAHs onto PET surface was assessed by analyzing remaining naphthalene in coconut oil at decided time intervals using only fluorimeter. When coconut oil is spiked with 10 ppm and 25 ppm naphthalene and stored in PET receptacles (surface area ≈ 150cm^2) separately 10 % and 14 % of naphthalene was adsorbed onto PET surface respectively for 130 hrs. When increase the surface area up to 450 cm^2 it was 26 % and 27 % respectively for 130 hrs. The concentration of PAH and surface area of PET were affected the removal of PAH from coconut oil onto PET surface.

To establish a rapid screening method to quantify PAHs in coconut oil standard addition method was followed. Based on standard addition method naphthalene levels found in coconut oil was 1.0 g / kg.

Overall the PAH concentration can be reduced from food products by storing them in PET receptacles. Reduction of PAH enhanced mainly by elevating the temperature and increasing the surface area of PET polymer.