B-05: Mechanism of contamination of 'maldive-fish' by polycyclic aromatic hydrocarbons

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"Maldive-fish" is prepared by dipping fresh tuna fish in boiling brine, sun-drying followed by coating the muscles with coconut petiole wood ash and smoke-drying. These treatments convert it to an acceptable flavour ingredient used in the preparation of curries. The 'maldive-fish' contains extremely high

concentrations of polycyclic aromatic hydrocarbons (PAH), some of which are known carcinogens. PAH are produced during pyrolysis of organic compounds. The objective of this study was to understand the distribution of PAH in the outer and inner regions in "maldive-fish" and to suggest possible mechanism of appearance of PAH in "Maldive-fish".

"Maldive-fish" samples were collected from markets in Kandy. The innermost and outer 2 mm regions of the ground 'maldive-fish' pieces (1 g) were extracted separately by macerating in distilled water (10 ml) and partitioning the PAH into 3 20 ml portions of dichloromethane. The dichloromethane extract was evaporated to dryness and the contents were dissolved in 5 ml HPLC grade hexane. The hexane extract (1 ml) was cleaned using Sep-Pak cartridge eluting with 3 ml hexane-dichloromethane (3:1). The eluate was evaporated to dryness and the contents dissolved in 500 μl acetonitrile-water (3:1) for analysis by Reverse phase HPLC using Chrompack ChromSper glass cartridge column. The individual PAH were separated at 25^{0}C using a binary gradient elution programme with 30 to 100% aqueous acetonitrile. Standard reference material 16476 for PAH from the National Institute of Standards and Technology, USA was used for estimation and comparison of the PAH fluoranthene, Pyrene, Benzo[a]anthracene, Benzo[b]fluoranthene, Benzo[k]fluoranthene, Benzo[a]pyrene, Dibenzo[a,h]anthracene and Benzo[g,h,i]perylene.

The total mean PAH concentrations in the outer and inner regions of the "Maldive-fish" ranged from 885 to 5825 and 228 to 640 μg/kg respectively. The distribution in the outermost and innermost regions were 65-90% and 10-35% in different samples.

The production or accumulation of PAH in a food may occur by several methods. The PAH may be produced in the food due to action of heat. The PAH may be absorbed into foods containing high moisture content from the atmosphere or may be deposited from smoke on direct drying kilns. In the case of "Maldive-fish" the PAH may also be carried with the wood smoke used to coat the muscles prior to smoke curing. The extremely high concentrations of PAH observed on the outer surface of pieces indicate heavy deposition of PAH from smoke or from wood ash. The low concentrations of PAH observed in the innermost regions suggest possible absorption during early drying stages of fish containing high moisture concentrations. The heat transferred during smoke curing may not be sufficient to produce PAH on the muscles during drying.

Of the total PAH observed the known carcinogenic PAH (Benzo[a]anthracene, Benzo[b]fluoranthen. Benzo[a]pyrene and Dibenzo[a,h]anthracene) accounted for less than 4%. The bulk of PAH present were Fluoranthene and Pyrene which are non-carcinogenic.

In smoke curing of 'maldive-fish' the PAH contamination occurs mostly due to deposition from smoke and coating of wood ash. The bulk of PAH observed were non-carcinogenic.

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