SOLAR DEGRADATION OF AFLATOXIN B1 IN FOODS

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Detoxification of aflatoxins without reducing the nutritive quality of foods is a problem today, in recovering already contaminated foods. Aflatoxin B1 degrades in the presence of ultra-violet radiation producing new fluorescent compounds of lower toxicity (ref. 1). The solar radiation contains uv radiation in sufficient strength to degrade aflatoxin B1 and also possess the advantage of containing a wide spectrum of radiation, which may further degrade the initial uv degradation products of aflatoxin B1, removing the toxicity totally. The degradation of aflatoxins is already shown to depend on the combination of solvent and radiation (ref. 2).

When aflatoxin B1 was exposed in the solvents, ethanol, ethyl acetate, chloroform and edible oils to radiation (solar, uv at 254 and 365 nm and light from a fluorescent lamp), only the combination of solar radiation and oils (coconut, corn, sesame and soyabean) degraded aflatoxin B1, leaving no residual aflatoxins and new fluorescent compounds. All other combinations of radiation and solvents produced up to four new fluorescent compounds. When the resistance of aflatoxin B1 to solar degradation in rubberseed oil was examined by solar-irradiating at acidities 0.01 to 8.20% and viscosities 30 to 1303 (Redwood No.2), total degradation occurred only below 2% acidity.

The main limitations in solar-irradiation of the oils under laboratory conditions appeared to be the low penetration of radiation, through static layers of oil and the need to treat the oil in batches. To overcome these limitations a pilot plant was designed where oil was made to flow under gravity over a series of aluminium plates, placed in an overlapping cascade arrangement. In this apparatus oil moved at a layer thickness of 1.6 ± 0.2 mm and took 8 min. to flow through. In a single operation of irradiation 75% aflatoxin degraded in coconut oil, starting from concentrations 166-1250 ug/kg. Complete degradation occurred on repeated operations independent of the initial aflatoxin concentration in oil. The irradiated oil contained no residual aflatoxin B1 or new fluorescent compounds (ref.3).

Biological assay of extracts from solar-irradiated coconut oil was carried out by feeding four groups of day-old ducklings with the following solutions:

- Pure aflatoxin B1 in 2% propylene glycol (control)
- Extracts from toxic coconut oil after solar-irradiation in the pilot plant
- Extracts from non-toxic coconut oil after solar irradiation in the pilot plant
- 2% Propylene glycol (vehicle)

The non-toxicity of solar-irradiated coconut oil was confirmed by statistical analysis of the mortality pattern, gain in weight at death, the rate of gain of weight and the extent of bile duct hyperplasia of the ducklings. The ducklings fed with extracts from toxic oil after solar-irradiation did not show any significant difference from those groups fed with non-toxic oil and the vehicle ($p = 0.01$) confirming total degradation of aflatoxin B1 during solar-irradiation (ref.4).

No degradation of aflatoxin B1 occurred in powdered copra meal when exposed to solar radiation in the form of thin layers probably due to low penetration or the absorption of radiation by other constituents in foods (ref. 5).

The process is safe for industrial application for solar decontamination of aflatoxin B1 in edible oils.

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