

Assessing Acute Toxicity and Endocrine Disruption Potential of Selected Packages Internal Layers Extracts

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Abstract : In the scientific literature related to the widely understood issue of packaging materials designed to have contact with food (food contact materials), there is much information on raw materials used for their production, as well as their physiochemical properties, types, and parameters. However, not much attention is given to the issues concerning migration of toxic substances from packaging and its actual influence on the health of the final consumer, even though health protection and food safety are the priority tasks. The goal of this study was to estimate the impact of particular foodstuff packaging type, food production, and storage conditions on the degree of leaching of potentially toxic compounds and endocrine disruptors to foodstuffs using the acute toxicity test Microtox and XenoScreen YES YAS assay. The selected foodstuff packaging materials were metal cans used for fish storage and tetrapak. Five stimulants respectful to specific kinds of food were chosen in order to assess global migration: distilled water for aqueous foods with a pH above 4.5; acetic acid at 3% in distilled water for acidic aqueous food with pH below 4.5; ethanol at 5% for any food that may contain alcohol; dimethyl sulfoxide (DMSO) and artificial saliva were used in regard to the possibility of using it as a simulation medium. For each packaging three independent variables (temperature and contact time) factorial design simulant was performed. Xenobiotics migration from epoxy resins was studied at three different temperatures (25°C, 65°C, and 121°C) and extraction time of 12h, 48h and 2 weeks. Such experimental design leads to 9 experiments for each food simulant as conditions for each experiment are obtained by combination of temperature and contact time levels. Each experiment was run in triplicate for acute toxicity and in duplicate for estrogen disruption potential determination. Multi-factor analysis of variation (MANOVA) was used to evaluate the effects of the three main factors solvent, temperature (temperature regime for cup), contact time and their interactions on the respected dependent variable (acute toxicity or estrogen disruption potential). From all stimulants studied the most toxic were can and tetrapak lining acetic acid extracts that are indication for significant migration of toxic compounds. This migration increased with increase of contact time and temperature and justified the hypothesis that food products with low pH values cause significant damage internal resin filling. Can lining extracts of all simulation medias excluding distilled water and artificial saliva proved to contain androgen agonists even at 25°C and extraction time of 12h. For tetrapak extracts significant endocrine potential for acetic acid, DMSO and saliva were detected.

Keywords : food packaging, extraction, migration, toxicity, biotest

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