Short Communication

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Journal of Pharmacy and Pharmaceutical Research

2021
Vol.5 Issue 6

Biological Effects of the Plasticizer Tris (2-Ethylhexyl) Trimellitate

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Abstract:

Objectives: An alternative plasticizer, tris (2-ethylhexyl) trimellitate (TOTM), was developed from di-(2-ethylhexyl) phthalate (DEHP) for use in medical tubing. However, little is known about the biological effects of TOTM and thus its safety is not yet well-established. We investigated the leachability of TOTM from TOTM-plasticized Polyvinylchloride (PVC) feeding tubes. Furthermore, we studied whether TOTM influences the cell toxicity of human leukemia (HL)-60 cells, the cell proliferation of human breast cancer MCF-7 cells, and the binding affinity for human estrogen receptor α.

Methods: TOTM or DEHP-plasticized PVC feeding tubes were incubated with liquid nutriment containing soybean based salad oil. Thereafter, these solutions were mixed with extract solution and centrifuged, respectively. Obtained supernatant was served as extract sample. TOTM and DEHP were confirmed by high performance liquid chromatography (HPLC); molecular ion peaks corresponding to TOTM were detected by LC/mass spectrometry. The effects of these plasticizers on human leukemia (HL)-60 viability and breast cancer cell MCF-7 proliferations were investigated. Furthermore, the affinity of these plasticizers for binding human estrogen receptor (ER)-α was measured using an enzyme-linked immunosorbent assay (ELISA) kit.

Results: An existence of TOTM was confirmed in an extract sample by HPLC and LC/MS. Furthermore, TOTM decreased viability HL-60 cells while enhancing MCF-7 cell proliferation. However, these effects-as well as the activation of ER-α- were weaker by approximately 10-fold weaker for TOTM than DEHP.

Conclusion: The leaching of TOTM from TOTM-plasticized PVC feeding tubes is less toxic than DEHP, adverse effects may be associated with the production of ovarian estradiol via activation of a receptor-mediated signaling pathway. These findings nonetheless indicate that TOTM is a viable and safer alternative to DEHP for plasticizing medical devices for human use.We have discovered that TOTM from PVC feeding tubes was leached by exposure to salad oil. Furthermore, it has been demonstrated that TOTM may possess cell toxicity and estrogenic activity through a receptor-mediated signaling pathway. However, these reactions of TOTM are significantly weaker compared with that of DEHP. Therefore, additional research may be necessary to confirm and extend these observations.

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