Toxicity and Decomposition Potency of 3-Chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone (MX)

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Introduction

Drinking water is known to contain a variety of chlorinated organic compounds including trihalomethanes as by-products of chlorine disinfection. Among them, 3-chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone (MX) has been identified as a potent mutagen and quantified in the United States, Finland, Great Britain and Japan.¹⁾ We earlier reported the distribution of MX in drinking water in our country²⁾ and several genotoxicities in rat glandular stomach.³⁾ In our recent work, cell proliferation, lipid peroxidation in rats⁴⁾ and the combined effect of MX on other mutagens were demonstrated. In this work, we report the initiating and promoting activities of MX in rat and the stability of MX after chemical, physical and biological treatments.

Methods

One hundred and twenty Wistar rats (6 weeks of age, male) were divided into 6 groups. They were given 100 ppm *N*-methyl-*N'*-nitro-*N*-nitrosoguanidine (MNNG) as their drinking water and 5% NaCl containing basal diet for 8 weeks. After that time, 0–30 ppm MX and basal diet were given for 57 weeks. At autopsy, the stomach was histopathologically examined. The decomposition ratio of MX was determined from the change in mutagenicity after chemical (pH, SH compounds, teas, coffee), physical (temperature, UV) and biological (saliva, serum) treatments.

Results and Discussion

In histopathological examination, gastric erosions such as adenocarcinoma and atypical hyperplasia were noted in rats receiving MNNG and 10–30 ppm MX. Atypical hyperplasia was also found in rats receiving 30 ppm MX. These results show that MX has weak initiating and strong promoting activities in these animals.⁵⁾ The mutagenic activity of MX was reduced with an increase of pH and temperature; the activity was also inhibited by treatment with serum, UV, tea extract and SH compounds (glutathione, cysteine). Therefore, the risk function of MX should be considered in association with genotoxic properties and degradation efficiency *in vivo* and *in vitro*, and also with the daily intake by human beings.

References

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