*Biokinetics of silver (^{110m}Ag) in marine isopod

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Abstract

The bioaccumulation and retention of silver-110m were investigated in the marine isopod Idothea primastica. Retention of ^{110m}Ag in fecal pellets was also measured. The accumulation of ^{110m}Ag for non-moulting Idothea in brackish water was relatively high (CF $>10^3$) and independent of temperature between 10 and 20°C. The biological half-lives of ^{110m}Ag in non-moulting isopods and their fecal pellets were 231 and 130 days, respectively, and were independent of temperature. However, the loss rate of ^{110m}Ag in this organism was greater in sea water when compared with the value obtained in brackish water.

Resume

L'accumulation et la rétention du ^{110m}Ag ont été étudiées sur l'isopode marin Idothea prismatica. La rétention de cet isotope dans les pelotes fecales de l'animal a été également examinée. L'accumulation en milieu saumâtre du ^{110m}Ag sur cet isopode n'ayant pas encore mué, avait un facteur de concentration relativement élevé (CF $> 10^3$). La demie-vie biologique du radionucléide dans l'isopode et dans ces pelotes fécales, est indépendante de la température et elle est respectivement de 230 et 130 jours. Cependant, on a remarqué que le taux de perte du ^{110m}Ag présent dans cet organisme était plus élevé dans l'eau de mer que dans celui des eaux saumâtres.

Silver-110m has been detected in some marine organisms (Folsom and Young, 1965; Sjöblom, 1980). It enters the marine environment mainly from fallout and from the release of radioactive wastes originating from some types of reactors and nuclear reprocessing plants (Fukai and Murray, 1974; Preston et al., 1968). However the experimental data on the biokinetics of ^{110m}Ag in marine biota are limited (Pouvreau and Amiard, 1974; Pentreath, 1977). Pouvreau and Amiard found a very high concentration factor (CF $> 10^3$) for ^{110m}Ag in a crustacean, Pinnotherea pisum. However, this high value is among the exceptions observed in the literature. Furthermore, little is known about the biokinetics of ^{110m}Ag in either crustacea or other marine invertebrates. We report here some results from preliminary experiments on the bioaccumulation and retention of ^{110m}Ag in a marine isopod.

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Isopods (Idothea primastica) averaging 0.07 + 0.02 g wet wt. were collected from the Küçük Çekmece Lagoon in Istanbul. The gamme-emitting radionuclide ^{110m}Ag (as silver chloride, half-life 253 d) was used in this study.

It was observed that the accumulation and retention were strongly influenced by moulting. Molts cast during accumulation and retention periods were periodically radioanalyzed and found to contain relatively high levels of ^{110m}Ag compared to the moulting animals. For example, following 31 days' uptake and 17 days' loss periods, over 78% and 56% of the radionuclide, respectively, were lost with molts from moulting animals. For this reason, in the evaluation of our bioaccumulation and elimination results, only non-moulting animals have been considered.

Bioaccumulation from brackish water (salinity 6.54‰) by Idothea was followed during a period of 35 days under different temperature regimes. A relatively high concentration factor of about 1500 was reached at equilibrium. The accumulation of ^{110m}Ag at two different temperatures (10°C and 20°C) was identical indicating that the accumulation process was independent of temperature.

The elimination of ^{110m}Ag from contaminated Idothea and their fecal pellets were examined by transferring them into clean brackish water. Loss rates in animals and fecal pellets were not influenced by temperature between 10°C and 20°C. However, the loss rate for fecal pellets was significantly greater than that for whole animals. The biological half-lives for ^{110m}Ag release from fecal pellets were 2 days for the rapid component and 130 days for the slow component. Corresponding values for whole body loss from Idothea were 2 and 231 days. One group of contaminated animals was transferred into Marmara sea water (salinity, 21‰); it was noted that salinity significantly affected the flux of ^{110m}Ag from Idothea. The increase of salinity from 6.54‰ to 21‰ increased the loss rate of ^{110m}Ag from Idothea by factor of 1.8. The biological half-lives for loss were found to be 1 day for the rapid component and 125 days for the slow component under higher salinity regime. These results are in good agreement with those obtained for mussels (Unlu et al., 1984).

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