*Biokinetics of silver (^{110m}Ag) in mussels under different environmental conditions

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Abstract

The biokinetics of ^{110m}Ag in mussels (Mytilus galloprovincialis) have been investigated at 10° and 20°C in both Marmara sea water and Küçük Çekemece Lagoon water. CF's were found to be between 350-400 at different salinities and temperatures. Bioelimination was faster in sea water than in brackish water. Accumulation and loss measured at 20°C and subsequent tissue distribution of the radiotracer led us to believe that the binding forces between silver ions and soft parts of mussel may be influenced by ambient temperature during bioaccumulation.

RESUME

La biocinétique de ^{110m}Ag present dans la moule a été étudiée à une température de 10°C et de 20°C dans l'eau de la mer de Marmara, et dans l'eau de la lagune de Küçük Çekmece. Pour pouvoir comparer la biocinétique avec la cinétique de l'élimination, on a calculé le facteur de concentration (FC), la concentration de ^{110m}Ag, l'equilibre (p), le coefficient d'excretion (K), le temps de residence (τ), le flux (I), et la demi-vie biologique ($T_{bl/2}$). On n'a pas trouvé de différence entre les (FC) soumis à des diverses salinités et températures (entre 350-400); tandis que les taux des bioéliminations étaient sous l'influence de ces paramètres. Cela nous montre que le processus de fixation des ions d'argent sur les tissus de la moule doit être dépendant de la température pendant la bioaccumulation.

Radiosilver is found in liquid discharges of nuclear power plants in measurable quantities or in sediment and organisms in the vicinity of discharge areas (Fukai and Murray, 1974). In spite of its importance only a few experimental data are available on its metabolism and biokinetics. A limited number of experiments on the accumulation and loss of ^{110m}Ag with various marine organisms have been carried out by some workers (Dutton, 1975; Pouvreau and Amiard, 1974; Salo, 1979). The present work attempts to obtain data on biokinetics of ^{110m}Ag in mussels under different salinity and temperature conditions.

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Mussels were collected from the Marmara Sea and Kucuk Cekmece Lagoon (brackish water) and held in their original water containing 0.25 μCi ^{110m}Ag (9.25 kBq) l^{-1} at 10°C and 20°C. The salinities were 6.3‰ and 23.8‰ at 10°C; 9.9‰ and 22.6‰ at 20°C in brackish and sea water, respectively. The effect of soluble stable silver at concentrations of 50 and 100 μg l^{-1} on the bioaccumulation of ^{110m}Ag was also examined.

Concentration factors in mussels were found to be between 350-400 at different salinities and temperatures including the groups with an additional 50 μg l^{-1} stable silver. However with an addition of 100 μg l^{-1}, concentration factors were reduced to 94 at 10°C and to 200 at 20°C in brackish water and sea water, respectively. The results indicated that salinity and temperature differences did not play an important role in determining the concentration factor in an environment having no excess stable silver concentration. Very similar concentration factors have also been reported for the mussel Mytilus edulis (500 for the soft part, 250 for the shell) (Pouvreau and Amiard, 1974). However in the literature higher concentration factors have also been reported for other organisms, e.g. up to 1000 for crustaceans and algae (Salo, 1979) and 1500 for the isopod Idothea (Topçuoğlu et al., in press).

Bioelimination kinetics were clearly biphasic irrespective of temperature and salinity and loss rates at 10°C were 3 times faster in the slow compartment of organisms held in sea water ($T_{b1/2}$ = 40 days) than in those in brackish water ($T_{b1/2}$ = 109 days). Following ^{110m}Ag accumulation at 20°C and at higher stable silver concentrations, longer biological half-times were obtained when compared with comparable mussels held at 10°C. This may be due to a stronger absorption of silver by the soft parts of mussels during the bioaccumulation phase under these conditions.

It may be concluded that salinity and temperature have little effect on total ^{110m}Ag accumulation, while higher temperature causes a stronger absorption of the radiotracer to the soft parts of mussel. It has been found that higher salinity increases the desorption of silver from the mussel, a finding which is in good agreement with results for the isopod Idothea (Topçuoğlu et al., in press).

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