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应用电阻率法确定浅水砂质沉积物中的扩散系数

高增文,郑西来,徐芹选,卢学伟

（中国海洋大学海洋环境与生态教育部重点实验室，青岛 266100）

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摘要 根据无限稀释溶液中物质的分子扩散系数，估算沉积物中污染物的扩散系数时，需确定地层因数与孔隙度的关系.本研究将Miller Soil Box应用于测定青岛近岸不同粒径砂质沉积物与孔隙水的电阻率，以确定沉积物的地层因数，并结合沉积物的孔隙度，通过曲线拟合建立地层因数与孔隙度的关系式.研究结果表明，运用Ullman和Aller给出的经验m值(当$\varphi\le0.7$时，m取2)计算近岸砂质沉积物中污染物的分子扩散系数，将会引起40%~50%的误差；近岸砂质沉积物地层因数与孔隙度的关系可以采用Archie公式表示，即$F=\varphi_{-m}$，$m=1.52$；经验证分析，可取$m=1.52$代入$D_s=D_0\cdot\varphi_{m-1}$公式，计算浅水砂质沉积物中污染物的分子扩散系数.

关键词 砂质沉积物,扩散系数,电阻率,地层因数

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Estimation of bulk diffusion coefficients in nearshore sandy sediments by resistivity method

GAO Zeng-wen, ZHENG Xi-lai, XU Qin-xuan, LU Xue-wei

（Key Lab of Marine Environmental Science and Ecology, Ministry of Education, Ocean University of China, Qingdao 266100, China）

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Abstract Formation factor, F, can be estimated from Φ, porosity of sediments, for calculating bulk sediments diffusion coefficients from free solution diffusion coefficients. To determine formation factor, resistivity of pore water and sandy sediments with different diameter, originated from Qingdao's seashore, were measured by using a modified Miller Soil Box, then the exponent, m, of Archie formula was obtained through curve fit. The results indicate that using the empirical m(for $\varphi\le0.7$, $m=2$) given by Ullman and Aller to calculate bulk diffusion coefficient may introduce 40%~50% error; the relationship between F and φ can be expressed as $F=\Phi^{-1.52}$ for nearshore sandy sediments; substitution of $m=1.52$ into $D_s=D_0\cdot\varphi_{m-1}$ is verified to be suited for calculating bulk diffusion coefficient in sandy sediments.

Key words sandy sediment diffusion coefficient resistivity formation factor

通讯作者:

高增文 gaozengwen@163.com

作者个人主页: 高增文;郑西来;徐芹选;卢学伟