

Dispersion Rate of Spilled Oil in Water Column under Non-Breaking Water Waves

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Abstract : The purpose of this study is to present a mathematical phrase for calculating the dispersion rate of spilled oil in water column under non-breaking waves. In this regard, a multiphase numerical model is applied for which waves and oil phase were computed concurrently, and accuracy of its hydraulic calculations have been proven. More than 200 various scenarios of oil spilling in wave waters were simulated using the multiphase numerical model and its outcome were collected in a database. The recorded results were investigated to identify the major parameters affected vertical oil dispersion and finally 6 parameters were identified as main independent factors. Furthermore, some statistical tests were conducted to identify any relationship between the dependent variable (dispersed oil mass in the water column) and independent variables (water wave specifications containing height, length and wave period and spilled oil characteristics including density, viscosity and spilled oil mass). Finally, a mathematical-statistical relationship is proposed to predict dispersed oil in marine waters. To verify the proposed relationship, a laboratory example available in the literature was selected. Oil mass rate penetrated in water body computed by statistical regression was in accordance with experimental data was predicted. On this occasion, it was necessary to verify the proposed mathematical phrase. In a selected laboratory case available in the literature, mass oil rate penetrated in water body computed by suggested regression. Results showed good agreement with experimental data. The validated mathematical-statistical phrase is a useful tool for oil dispersion prediction in oil spill events in marine areas.

Keywords : dispersion, marine environment, mathematical-statistical relationship, oil spill

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