Laboratory study of oil slick behaviour in sea water in cold weather conditions: Improving the oil spill response system for the Barents Sea

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Introduction

Volumes of oil transported in the Barents Sea, Kola Bay and through the North-East Sea Route increase every year and will continue to grow several times. The increased number of oil carrier vessels will escalate the risk of oil spills. In 2006, the Murmansk State Regional Centre for Standardization, Metrology and Testing (MSCM), in cooperation with Statoil, established a laboratory to determine chemical characteristics and analysis of weathered oil. The laboratory is outfitted with equipment for the determination of physico-chemical parameters of oil and a “cold room” to research the interaction of oil with sea water in the temperature range of 5-15°C.

Results

Flash point temperature

The samples used in this study were collected from oil terminals and tankers carriers. Oil spill can be collected safely only when the flash point temperature is below 60°C, otherwise it can result in explosion in the holding tanks of oil vessels. Figure 1 illustrates that the light oil can start inflaming within 30 minutes after the initial time of the oil spill.

Emulsion viscosity

Measuring viscosity allows forecasting possible leak from harbour boom and choose the optimal oil skimmer type. There is a risk of leak from boom fencing for oil emulsion with viscosity under 1000mPa. A mop skimmer is used for oil emulsions with viscosity from 1000mPa to 20 000mPa. For oil emulsions with higher viscosity, vane type skimmer is recommended. Figure 2 shows that, for 2-2.5 hours after the oil spill, emulsions from oil samples Nos. 2, 3, 4 can escape from boom fencing and, after that period, the emulsion can be cleaned with a mop skimmer.

Water saturation

Mixing of oil with seawater spill increases volume. Fig.3 shows the amount of water saturated by oil. During the first day, samples Nos. 2&3 saturate 80% of seawater, sample No. 1 saturates 73%, No. 4 53%, and sample No. 5 only 17% of seawater.

The relevance of research

This study will aid in devising a strategy for oil spill clean-up in the Barents sea. In case of accident, the database will forward oil specific data to Hydrometeorology to determine rescue services, instruments, force and means to react adequately and work efficiently in oil spill elimination.

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