

Spray Characterisation of Glycerine - Water Mixture, Using a Spill-Return Atomiser (SRA)

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Abstract

The risk of exposure to hazardous materials, in many industrial environments and in everyday life due to the possibility of terrorist attacks, is widely recognised. It is therefore necessary to have robust decontamination equipment to limit the effects of hazardous materials and in turn protect human life and assets. This can be done by the application of neutralisation (coverage) and rinsing techniques to the hazardous materials. The overall aim of this investigation was to characterise the spray of the glycerin - water mixture and obtain their operating range of viscosities when using a spill-return atomiser in decontamination processes. The atomiser must provide similar spray characteristics when compared with the sprays which were produced by using water. A novel miniature spill-return atomiser was capable of producing fine drop sizes of less than 21 microns at high pressure (<120 bar) and low flow rates (<0.5 l/min). Different glycerin and water mixtures were prepared and tested. The percentage of glycerin to water were used was between 25% - 75%.

This paper highlights the results and analysis of the performance tests which were carried out in characterisation of the spray mixtures. The effect of pressures and flow rates of the mixtures on the droplet sizes compared with that of pure water are also shown together with the corresponding viscosities of the glycerin-water mixtures at various room temperatures.

It was concluded that, SRA producing fine sprays at low flow rates, is robust and versatile enough to be use in the decontamination processes, using high viscous naturalising agents. The highest percentage of glycerine solution that can be used is 55% at 90 bar with viscosity of the mixture of ≈ 11 CP. The use of 55% glycerine solution at 90bar provides an SMD ($\approx 21 \mu\text{m}$) within 10% of the SMD ($\approx 18 \mu\text{m}$) of water at the same pressure. It was found that increasing the glycerine content beyond this gave a SMD that was in excess of the 10% variance limit. Increasing the pressure to 110bar and 120bar can reduce the SMD at 55% glycerine solution. The atomised (spray) flow rate of 55% glycerine solution at 90bar is 0.4628l/min which is 88.9% higher than that of water at the same pressure. The total flow rate to the atomiser is 11.9% lower than that required when using 100% water.

Key words: spill-return atomiser, decontamination, glycerine - water mixtures,

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