

Water-oil flows transition from stratified to inter-dispersed in horizontal pipeline system.

ABSTRACT

The spatial distribution of water and oil in horizontal pipe flows was studied experimentally at differing inlet water fractions and mixture velocities. Under most conditions the pattern was oil-continuous in water-dispersed or water-continuous in oil-dispersed and there is entrainment in the form of drops of phase into the other. The investigations were carried out through the cross-sectional phase distribution in the flow of mixtures of water and oil in a horizontal 0.0254 m bore stainless steel section. The phase fraction distribution was determined using a traversing beam gamma densitometer, with the beam being traversed at 0°, 45° and 90° of the vertical line passing through the axis of the tube. Measurements were made at 1.0 m and 7.72 m along the 9.7 m test section length tube. The measurements were made using the Two-phase Oil Water Experimental Rig (TOWER) facility, which allows the two fluids to be fed to the test section before separation and return again to the test line. The flow developed naturally from an initial stratified flow in which the oil and water were introduced separately at the top and the bottom of the test section respectively. It was found that the liquids were fully inter-dispersed by the time it reached the end of the test section. The phase fraction distribution was shown to be homogeneously mixed near the outlet of the test section.

Keyword: Water-oil flows; Phase distribution; Stratified-dispersed flow; Inlet water fraction; Mixture velocities.