Abstract

Air entrainment due to plunging liquid jets can be exploited for a number of advantages. For example, to achieve good absorption coupled with good mixing in some gas-liquid reactors, plunging jet aeration provides a very simple and effective way of dissolving air in the reactors. In wastewater treatment and floatation process, plunging jet aerators are also used.

Air entrainment due to plunging liquid jet finds an application in Hydraulic Air Compressor. Hydraulic Air Compressor is a device that utilizes the energy of falling water, which entrains air bubbles, into a downcomer pipe, to compress it. These types of compressors were used for mining ventilation and other applications in United States, Canada and Europe during early 20th century. However, in recent times, these types of compressors do not find a preference in engineering practices. But due to present crisis of fossil fuels and increasing need of nonconventional renewable energy resources, may revive its potential application as an alternative air compression system. There are many advantages of Hydraulic Air Compressor. It has no moving parts, and the compression is nearly isothermal. There are many possible applications of Hydraulic Air Compressor, which includes wave energy recovery, tidal energy recovery, ultra low head hydraulic energy recovery etc. Apart from the above one may think of different end use of Hydraulic Air Compressor.

In view of these advantages of Hydraulic Air Compressor system, interest on tapping of hydraulic energy from the natural streams to compress air is increasing. In recent times, a few researchers have initiated some experimental studies for the basic understanding of the performance of such kind of air compressors.

The present investigation is mainly concerned with experimental studies on the basic hydrodynamic characteristics of plunging liquid jet system impinging on a free surface of a liquid body and its application in Hydraulic Air Compressor. The

development of two-phase zone below the free surface of liquid due to jet impingement is of key importance for air entrainment. It is therefore, prudent to study the two-phase hydrodynamics for the understanding of the mechanism of air entrainment due to plunging liquid jet system. In this study an attempt is also made to study the performance of Hydraulic Air Compressor along with the characteristics of two-phase flow through the downcomer pipe of the Hydraulic Air Compressor. To study the structure of two-phase flow, needle type electrical conductivity probes have been indigenously designed and extensively used in the present study. A nonlinear regression model from the experimental results has been developed to predict the air entrainment characteristics of Hydraulic Air Compressor. The air entrainment characteristics for jet impingement on free surface of liquid and also for Hydraulic Air Compressor have been discussed details.