Pressure Drop Ratio -- An Important Performance Parameter in Liquid-Liquid Hydrocyclone Separation

Minghu Jiang, Lixin Zhao and Jie He
Daqing Petroleum Institute
Anda, China

Fupeng Zhou
Daqing Petroleum Administration Bureau
Daqing, China

ABSTRACT

Liquid-liquid hydrocyclone separating method is a modern oil-contaminated sewage disposal method. Now the special function of pressure drop ratio in liquid-liquid separation, e.g. oil-water separation, is introduced by analyzing amounts of indoor experiment data. It dominates the application prospect of liquid-liquid hydrocyclone. For that reason, the relationships of pressure drop ratio versus total flowrate, pressure drop ratio versus split ratio, and pressure drop ratio versus the diameter of upflow outlet and their effects are researched.

KEY WORDS: Hydrocyclone, pressure drop ratio, separation

INTRODUCTION

Although the hydrocyclone separating method originated hundred years ago, its theory was not very perfect, but its application technology has changed with each passing day since recent years. Authors believe that the quantity of pressure drop ratio C would dominate the application prospect of liquid-liquid hydrocyclone under most circumstances, according to the practice in oilfield. Fig. 1 shows the sketch of hydrocyclone.

The pressure drop ratio is defined as:

\[
C = \frac{\Delta P_u}{\Delta P_d} = \frac{P_i - P_u}{P_i - P_d}
\]

which refers to the ratio between upflow pressure drop \( \Delta P_u \) (difference between the inlet pressure \( P_i \) and the upflow pressure \( P_u \)) and downflow pressure drop \( \Delta P_d \) (difference between the inlet pressure \( P_i \) and the downflow pressure \( P_d \)), is an important parameter that indirectly connects the pressure drop and the pressure. About solid-liquid hydrocyclone, we would increase its separation efficiency by increasing its inlet pressure, but the case of liquid-liquid hydrocyclone is different. More higher inlet pressure means more higher inlet velocity, which would cause liquid drops to break and increase separating difficulties. Furthermore, oilfield application requires as little additional power consumption as possible. Usually, the given pressure is under 0.5 MPa, which means that we must try best to reduce the energy consumption of hydrocyclone itself, so that the upflow could have enough pressure to ensure the draining of water-contaminated oil, and the downflow ensure the draining of oil-contaminated water. And at the same time, there must be enough pressure left to mate with other equipment. For that reason, it is very important to study the pressure drop ratio for the application of hydrocyclone.

RESEARCH AND ANALYSIS

Relationship Between Inlet Flowrate \( Q_i \) and Pressure Drop \( \Delta P_d \)

The pressure drop is an important performance parameter of the hydrocyclone, its value doesn’t have direct influence upon the hydrocyclone’s efficiency, but it can influent flowrate \( Q_i \) and split ratio \( F \) (refers to the percentage of upflowrate to inlet flowrate, i.e. \( 100 \times \frac{Q_u}{Q_i} \)%). The mixed fluid of two kinds of liquid mediums, such as water and oil, transport through the hydrocyclone. Its pressure drops are divided to \( \Delta P_u \) and \( \Delta P_d \). For de-oil hydrocyclone, water is successive phase and oil is dispersal phase. So it is very important to study \( \Delta P_d \), which indicates the main energy loss. The well-designed hydrocyclone has not only higher separating efficiency, but also as...