Short Communication

A Coalescer for Soybean Oil Emulsions

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ABSTRACT

A simple device was designed, consisting of alternate layers of absorbant cotton supported on fiberglass that accelerated the coalescence of oil droplets from an emulsion of soybean oil in aqueous isopropyl alcohol. Separation was generally complete in 90 min or less.

INTRODUCTION

Extraction of oil from soybean flakes with hot (77 C) aqueous isopropyl alcohol (IPA) yields a miscella that on cooling and standing for a sufficient time separates into an oil phase and an IPA phase. The separation can be accelerated by the use of a coalescer that causes the oil droplets in the emulsion to come together and form the oil phase in the phase separator, which is downstream from the coalescer (1). In our design of a continuous pilot-plant extraction process, it was important to have the phase separation completed in less than 90 min so the IPA phase could be recycled to the extractor to extract more oil from soyflakes in a continuous closed loop (2).

PROCEDURES AND RESULTS

In preliminary experiments, with a coalescer made from alternate layers of absorbant cotton and fiberglass, the simple device worked surprisingly well for coalescing oil from emulsions of soybean oil in aqueous IPA. However, the device was only effective at linear velocities ranging from 6 to 90 cm/min.

Design criteria for a coalescer to be used in the pilot-plant process were based on a mass rate of flow of 1250 g/min of miscella from the extractor. The nominal diameter, D, of the coalescer was calculated as follows:

$$D = \sqrt{\frac{4\,W\,v}{\pi\,V}}$$

where: W = mass rate of flow, g/min; V = average linear velocity, cm/min; and v = specific volume, cm^3/g.

For miscella at a density of 0.8 g/cm^3, v = 1.25 cm^3/g. Assume V = 40 cm/min, which is near the middle of the range that limits coalescence. Then we can calculate the diameter, D = 7.05 cm or ca. a 3-in. id nominal pipe. The coalescer developed for the pilot-plant continuous extraction process with IPA was constructed out of seven 3-in. diameter by 1-in. thick alternating layers of absorbant cotton and fiberglass compressed into a bed 1.5-in. thick (Fig. 1). The bed was held together by a perforated plate on each end secured with a bolt. The compressed bed was placed in a 3-in. diameter flanged stainless-steel housing and installed downstream from a heat exchanger and the miscella pump. Although complete coalescence was normally accomplished by settling in the phase separator for 6 or more hours, with the coalescer, separation was complete in 90 min or less.

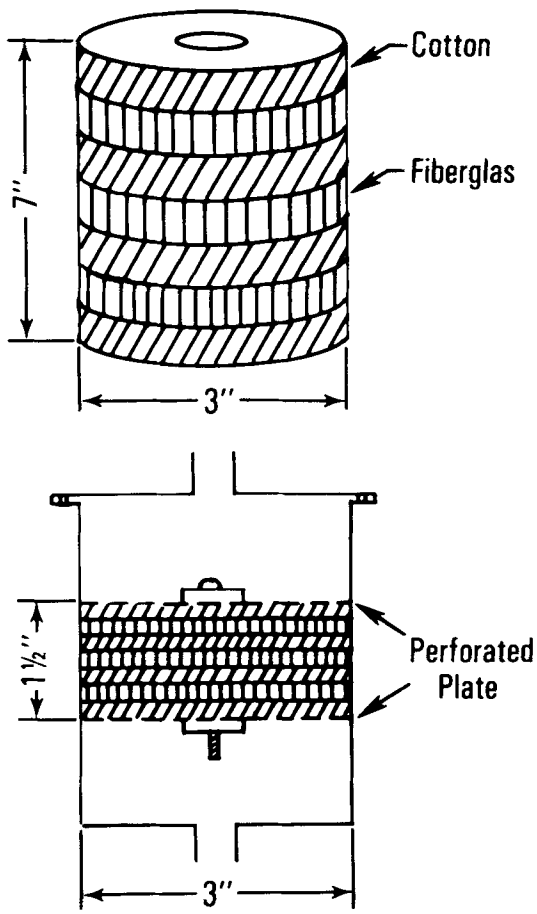

FIG. 1. Coalescer designed for pilot-plant process.

REFERENCES

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[1]The mention of firm names or trade products does not imply that they are endorsed or recommended by the US Department of Agriculture over other firms or similar products not mentioned.