Aggregate Analysis as an Aid in Soil Structure Studies

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From the physical point of view a soil may be pictured as being made up of mechanical and structural elements. The mechanical elements are the individual primary particles of various sizes such as sand, silt, and clay. The structural elements are crumbs or granules of various dimensions which have been formed by the aggregation of smaller mechanical elements. They are primarily responsible for all structure relationships.

The ability of a soil to break up into crumbs or granules has been defined by Zacharov as the structure capacity of the soil. In other words, it is the state of aggregation of a soil. However, one must distinguish between two types of aggregates, those stable only in the dry state and those stable in an excess of water. The latter type is responsible for good structure relationships. A measurement of these aggregates would be called an aggregate analysis of the soil.

Various methods may be used for making aggregate analyses of soils. Any of the common sedimentation methods could probably be used with certain modifications. In this study particular attention will be given to the use of the elutriation method. The principle of the elutriator is based on the separation of particles by a moving stream of water. Separations of the various sized particles are accomplished by regulating the velocity of water such that it will just balance the rate of fall of the particle, as calculated by Stokes' law. Particles with a slower rate of fall will be carried with the water stream.

Description of Elutriator

The elutriator used in this study is a modification of the Kopecky apparatus. It consists of three elutriation tubes of different diameters. These tubes are arranged with the tube of smallest diameter connected directly to the water supply; it is in this tube that the soil is placed for analysis. The third elutriation vessel is the largest in diameter and possesses an outlet and a piezometer tube. The piezometer tube is merely a small capillary which indicates the velocity of water in the third tube, which is arranged for measuring the velocity of the water stream.