

## Grit Characterization for Process Optimization at EPCOR's Gold Bar Wastewater Treatment Plant

Ensuring only clean, safe effluent reaches our receiving water bodies is complex and costly but is of primary importance to EPCOR Water Services. Looking for solutions, EPCOR turned to the **Edmonton Waste Management Centre of Excellence (EWMCE)** to undertake a thorough analysis of the particle size distribution of the grit from different stages of wastewater treatment process.

Grit is the inorganic solid material that comes to the wastewater treatment plant with the wastewater flow. Prior to wastewater treatment, these solids need to be removed and handled separately. During the pre-treatment phase the grit chamber is the place where these solids are removed. To check the efficiency of the grit chamber, analysis of particles that passed through the chamber and moved into the process system was important for the design/development of a solution.

The objective of the project was to characterize the grit particles in the:

- Solids removed by the grit chambers.
- Solids carried over to the primary treatment process.
- Solid material collecting in the anaerobic digesters.

### Background Information:

- Present design criteria for aerated grit chambers call for 95% removal of particles having granulometric size of 200  $\mu\text{m}$  or larger along with other predominating inorganic solids of equivalent settling characteristics.
- Grit often consist of sand, gravel, stones, cinders, broken glass, metallic particles and other inorganic material, with little or no putrescible (biodegradable) matter.
- Grit is considered to have two basic characteristics:
  - Mostly containing inert material with little or no putrescible organic matter and,
  - Having greater settling velocities than those of putrescible organic matter.



Fig. 1: Dried grit sample (from anaerobic digester) before analysis

### Method:

All samples were analyzed for moisture content, total solids, and volatile solids using Standard Methods. Sieve analysis of solid grit samples was carried out according to ASTM Standard Method for Particle Size Distribution Analysis of Soils D-422. For primary sludge and digester sludge samples, in which the grit was mixed inseparably with sludge and is a minority component in the sample, the EWMCE developed a new procedure specific for the analysis of the particle size distribution in these samples.

**Findings:**

Characterization of grit collected at different stages of the treatment process provided insight into the effectiveness of the removal processes and the nature of the solids removed.

- The solids separated from the wastewater in the grit chambers were mostly large inert particles, but there was a considerable organic component that increased the size of the particles.
- The raw material removed was composed of  $95.3 \pm 2.5$  % particles larger than 212  $\mu\text{m}$ , which is a very good indication of expected performance of the plant's grit chambers.
- The relative proportions of the different size classes changed only slightly over the time of the study (spring and summer 2012), suggesting a relatively consistent performance of the grit chambers.
- Grit was also found in primary sludge, but only in a relatively small quantity.
- Detailed evaluation of grit distribution in the anaerobic digester suggested that precipitation of inert struvite minerals contributed to the observed remarkable difference between the particle size distribution in the digester to that found in the primary sludge.

**Application:**

- Characterization results obtained will be used by the plant's engineers for the evaluation of the performance and optimization of the aerated grit chambers.
- Design engineers will then be able to create a more efficient design of solids handling.

Currently the EWMCE is working with different clients on several projects. We have the expertise, equipment and techniques to assist clients and create customized solutions to improve your production or operational processes.

**Contact: Dr. Hassan Katalambula, PEng, 780-969-8448**