



## Filter Facts Media Shape

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A photograph showing several piles of silica sand and filter media. On the left is a large pile of fine, light-colored sand. In the center and right are piles of larger, spherical, light-colored filter media beads. The background is a light gray grid with faint, semi-transparent text including "Sphericity", "Porosity", and "Integral".

**Featuring Colorado Silica Sand®**  
**Ask for it by name**

# Roundness and Sphericity

## Media Shape

The debate continues among environmental engineers and designers as to whether round (smooth) and spherical (like a ball bearing) grains are better than angular and elongated media.

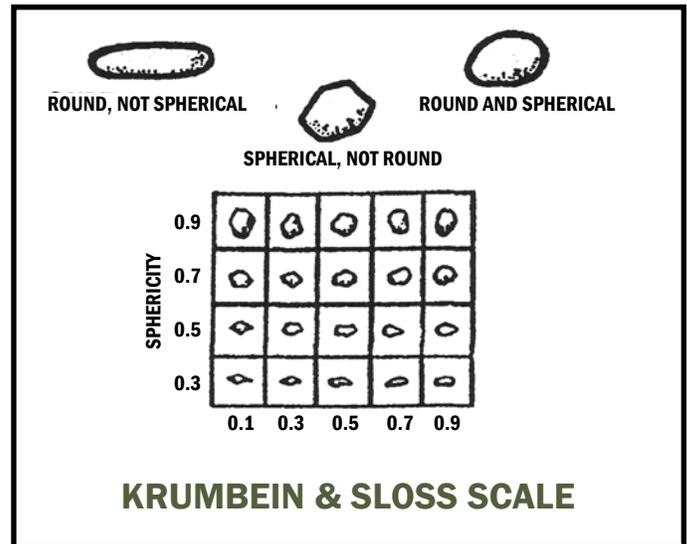
Initially, both the environmental and energy industries felt that angular particles had advantages over round and spherical media. In the oil and gas industry, millions of tons of sand are used in hydraulic fracturing annually. The sand is pumped into hydraulically induced fractures to augment the production of oil and gas. As late as the 1970s, there was a belief that angular particles were advantageous as the rough and elongated particles would create large pore spaces for increased production. In very shallow applications this is somewhat true, but most quality sands will commence crushing at 2000 psi closure. Rather than maintaining high porosity, the angular sands broke, even shattered, under the effective stress and the pore spaces were clogged.

Round and spherical media, however, carried the effective stress more uniformly over a large area, thus reducing the affect of crushing and maintaining a substantially higher conductive channel for the oil and gas. Today, the American Petroleum Institute recommends a minimum of 0.6 Roundness and Sphericity on the Krumbein scale, and typically operators are insisting on 0.7 or higher (See Figure 1). Premier Silica is one of the few companies that has sand that meets the strict requirements of the petroleum industry.

In water treatment applications, conventional wisdom assumed the angular and flat particles helped trap particulates near the top of the filter, thus preventing the flow of solids through the system (See Figure 2). This is not debated; it was simply too effective! Solids became trapped in the top few inches of the filter - literally blinding it. The angular or elongated grains tended to interlock, preventing the uniform and deep penetration of particulate matter into the filtration bed. Not only was there a need to increase the frequency of backwashing to clean the system, but longer backwashing times and higher pressures were required to free the solids from the angular grains which tended to interlock, preventing uniform fluidization (See Figure 3). "Channeling" became a common problem and filter beds were difficult to clean of particulates and floc. Media replacement was a constant ritual as the higher pressures required to clean the filter promoted media loss.

Round and spherical media, however, proved to have major advantages (See Figure 4). Not only did the more uniform shape promote deeper penetration of particulates into the bed (hence longer filter runs), but

Figure 1



backwashing efficiency improved dramatically as the round and spherical grains broke free easily and fluidized completely (See Figure 5). The round and spherical media also tended to rotate against each other, effectively scouring adjacent particles clean of tenacious solids. Backwashing frequency, time and pressure were all reduced. Media replacement costs went down.

Properly sized and closely graded round and spherical media allows for more uniform filtering action, which in turn allows for deeper filtering penetration. This accomplishes primarily two things: 1) Backwashing cycles are reduced, saving backflush (hence clean) water and reducing the time the filter bed is out of action. We have had customers report that backflush water loss has been reduced to as little as two percent compared to five, six, or even ten percent using lower quality media. The savings in backflush water can be sizeable indeed. 2) By utilizing deeper filtering penetration made possible by round and spherical media, bed areas can be reduced (or effluent volumes increased) thus creating possible savings in expensive construction costs. Increased efficiency and reduced backflush water can have the effect of literally eliminating the costs of proper filter media through increased savings.

Premier Silica is a company that has the proven ability to produce the type of gradations that industry needs to overcome most challenges. Our Colorado Silica Sand<sup>®</sup>, made up of non-conglomerated grains, can be screened to much tighter gradations than is possible with angular or elongated material. The filtration industry can benefit from the superb natural characteristics of our material.

Figure 2

### Filtering: Angular Sands

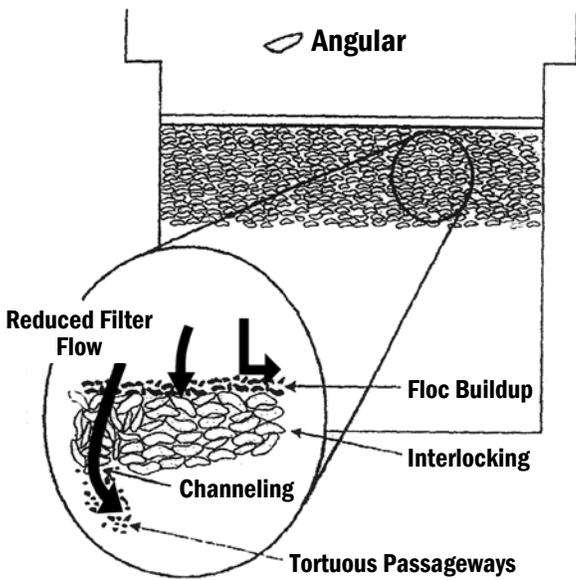


Figure 4

### Filtering: Round & Spherical Media

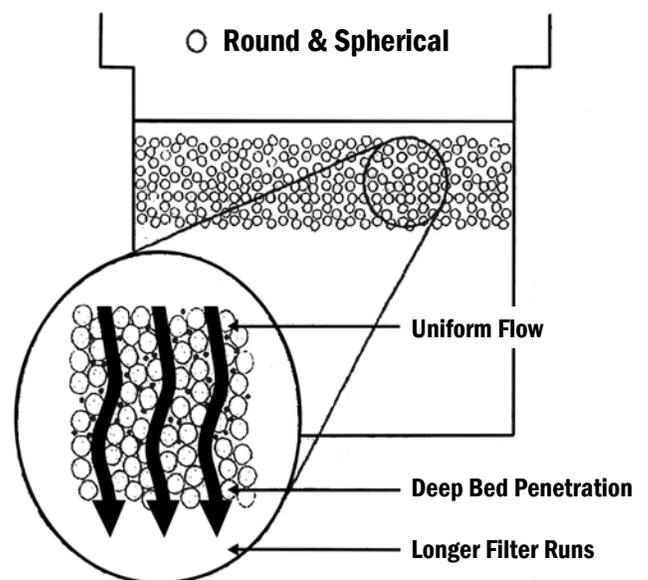


Figure 3

### Backwashing: Angular Sands

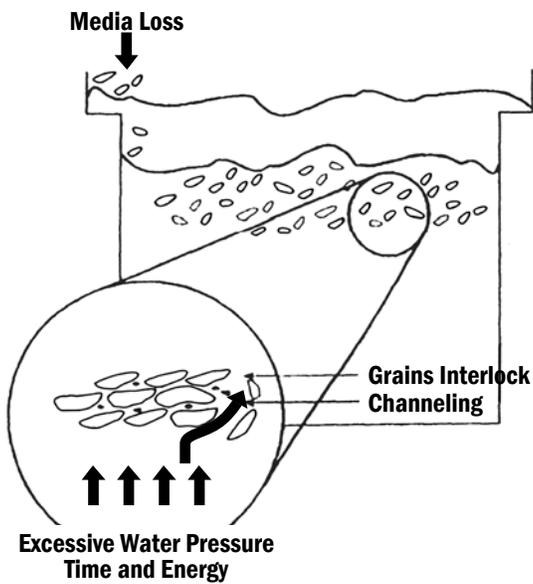
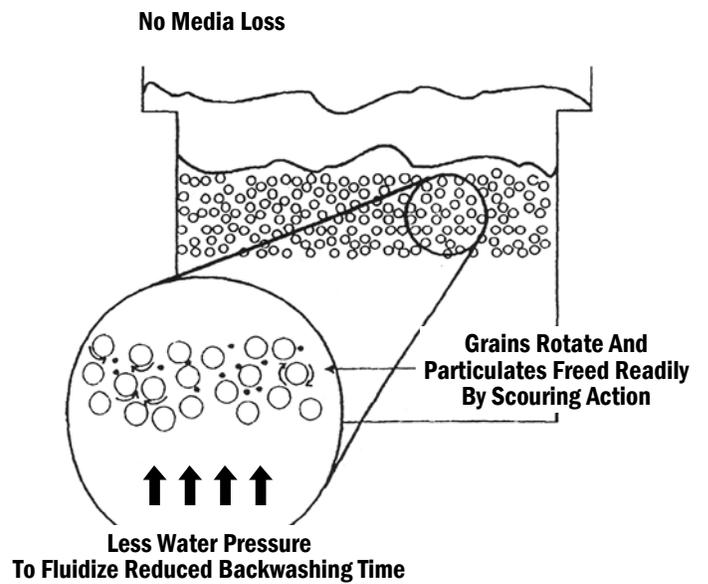


Figure 5

### Backwashing: Round & Spherical Media





### DISCLAIMER

The technical data contained herein is subject to change without notice and does not represent a commitment on the part of Premier Silica or its representatives. Over time and even within the same shipment, product gradations as well as physical and chemical characteristics may fluctuate due to natural variations in the raw product. It is recommended that the user request current technical data before making any design decisions.

### WARNING

**CONTAINS FREE (RESPIRABLE) SILICA  
DO NOT BREATHE DUST FROM THIS PRODUCT  
NEVER USE FOR SAND BLASTING**

This material contains fine (respirable) silica dust. If you inhale dust from this product, you may develop silicosis, a severe, irreversible lung disease that can cause death. The National Institute for Occupational Safety and Health (NIOSH), the International Agency for Research on Cancer (IARC) and the American Thoracic Society (ATS) link inhalation of silica dust to lung cancer. Medical reports link inhalation of silica dust to crippling arthritis. Exposure may cause skin and eye irritation.

**NEVER USE THIS MATERIAL WITHOUT APPROVED RESPIRATORY PROTECTIVE EQUIPMENT**

For approved respiratory protective equipment, refer to the National Institute for Occupational Safety and Health (NIOSH), the Occupational Safety and Health Act (OSHA) and the Mine Safety and Health Act (MSHA). See applicable Federal Laws:

29 CFR §1910.134 and 29 CFR §1910.1000

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