Refractron
TECHNOLOGIES CORP.

Cleaning Porous Ceramics

Porous ceramics are used for a variety of applications including filters and diffusers. Like any product in these applications, they may become clogged over time. An advantage of porous ceramics is that they may be cleanable by a variety of methods and are usually reusable. There is not one universal procedure for cleaning because it depends on the application and the type, size and nature of the contaminant to be removed.

Refractron's porous ceramics are glass-bonded aluminum oxide that forms a porous structure with a series of interconnected passages of irregular sizes and shapes. Depending on the application, contaminants may plug these passages and at some point cleaning is required. This material composition should not be exposed to hydrofluoric acid, phosphoric acid. As a rule any fluids should be in a pH range of 4 to 10.

In order to develop an optimum cleaning procedure the type of contaminant must be determined. Contaminants fall into three categories-

- Inorganic- typically consists of solids of metals, salts, oxides, hydroxides and mixtures of materials.
- Organic- generally oils, greases, carbon, gums, tars and polymers.
- Biological- includes algae, fungi, proteins and other food or plant based materials.

These contaminants may not be present alone but in combinations and many times may require more than one procedure in succession to be effective. This is a trial and error approach that is necessary by the end-user to determine the most effective and practical cleaning technique. For those not interested in this, there are independent, regional companies that specialize in cleaning porous materials, usually porous filters.

The following is a listing of various typical cleaning techniques:

Pressure Washing or Steam cleaning- is an effective technique in removing gross amounts of contaminant as an initial cleaning step when removing from service.

Reverse flush- an effective technique using gas blowback or liquid backwash sometimes incorporated into the process or used in a separate cleaning set up. This uses pulses of fluid in a reverse flush as an effective method to dislodge contaminants.

Soak and flush- a simple but effective technique in many applications where particulate contaminants are not lodged deep within the pore structure or there are organics that can be broken down by soaking in a solvent or detergent. (See the paragraph on cleaning solutions) Mechanical scrubbing and brushing may be combined with this technique to remove surface contaminant.

Ultrasonic cleaning- if the particulates are entrained within the depth of the pore structure ultrasonic cleaning may be the best way to clean the porous ceramic. If there is a solvent or cleaning agent for the contaminant it is recommended to flush with the solvent before ultrasonic cleaning.

When used with the proper detergent solution ultrasonic cleaning is effective in removing embedded particles.

Incineration- if the contaminant is combustible (usually organic), it may be removed by oven burn out under controlled conditions. Generally organics would burn out at temperatures from 570 to 750 degrees F (300 to 400 degrees C). The maximum temperature for the alumina porous ceramic is 1470 degrees F (800 degrees C). The duration of the cycle may be up to several hours depending on the size of the part and the equipment. If the contaminant is mineral based, then firing at a higher temperature (900 degrees F plus), may affect the chemical composition of the ceramic. Following the incineration, ultrasonic cleaning and/or flushing should be done to remove combustion by products and particulate matter.

Cleaning solutions can be important in obtaining optimum cleaning results and may be combined with the abovementioned cleaning techniques. The object is to pick up the contaminant from the pores and suspend it in the detergent and then flush is away. The cleaning solution or detergent is chosen based on the type of contaminant.

For inorganic compounds, dilute acids that will not attack the ceramic such as nitric, citric and oxalic may be used with detergent additives. Dilute caustics such as the commercial scale removers made by Oakite and Calgon may be effective. Avoid phosphoric acid and hydrofluoric acid and stay within the pH range 4 to 10.

For organic contaminants, caustic cleaners usually work best in addition to solvents, soaps and detergents. In the case of a mixture of contaminants use caustics to remove oils then acidic cleaners to remove scale and mineral deposits.

For biological contaminants, oxidizing agents such as Clorox, peroxide in addition to acidic and caustic cleaners. For protein and food residues there are commercially available cleaning agents.

Rinsing- With ANY of the cleaning methods the final step should be rinsing with clean water. Depending on the application and pore size, filtered water may be required. A thorough rinsing is required to not only remove contaminant, but also residual cleaning solution that may contaminate the process.

Testing- Following the cleaning process the porous ceramic should be checked for cleanliness and integrity to make sure it was not damaged. Ideally a new part should be tested as a benchmark in addition to the dirty part to compare to verify the cleaning technique. This is done with airflow vs. pressure drop test and, for filters, many times a bubble point test.

In conclusion, an effective cleaning procedure may take time for the user to develop and optimize. It is up to the user to follow all appropriate safety procedures when operating equipment and working with chemicals. Finally, remember these are only suggestions and guidelines and not a recommendation. The user of the porous ceramic is responsible for determining the actual cleaning procedure, as it is unique to the individual application.