# DESIGN OF SYNTHETIC BIOMEDIA FOR EFFICIENT BIOFILTRATION

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# PURPOSE OF BIOMEDIA

1. Provide high surface area biofilms to the gas stream, containing the contaminants;
2. Allow biomass attachment to the biomedia surface;
3. Allow gas and liquid to be distributed evenly within the biofilter bed; and
4. Allow excess biomass growth to slough-off and exit the bed, without plugging the biomedia.

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**Dr. Rakesh Govind**

# FAVORABLE BIOMEDIA CHARACTERISTICS

1. **High biologically-active surface area**
   **Typical areas are in the range of 30 – 250 $ft^2/ft^3$ or 100 – 820 $m^2/m^3$**

2. **High void fraction (percentage of open space)**
   **Varies from 15% to 98%. Desired void fraction should exceed 80%.**

3. **Large free passage diameter – largest sphere that can pass through the packing; Provides resistance to clogging or plugging by biomass growth.**

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# FAVORABLE BIOMEDIA CHARACTERISTICS

continued

4. Low cost per unit surface area.

5. Low bulk density and good mechanical strength.

6. Low gas-phase pressure drop; and

7. Ability to distribute the water evenly and prevent gas channeling.

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# TYPES OF BIOMEDIA

1. Rock, Gravel, Lava Rock

   Disadvantages: - Low void fraction causes plugging
   - Using large gravel size decreases biologically active surface area
   - High bulk density (heavy)

2. Fibrous mesh pads

   Disadvantages: - Small free passage diameter causing media plugging
   - Compresses due to biomass film weight
   - Needs to be cut to filter diameter and requires large number of pads

# TYPES OF BIOMEDIA

continued

3. **Polyurethane foam pieces**

   **<u>Disadvantages</u>:**
   - **Fills up with biomass and prevents dead biomass from sloughing off effectively**
   - **Poor mechanical strength**
   - **Does not distribute water evenly**

4. **Extruded plastic, random packings**

   **<u>Disadvantages</u>:**
   - **Identical to packings used in gas absorption and stripping towers, but are not designed for biological growth on surface**

# TYPES OF BIOMEDIA

continued

5. **Structured Packings**

**Used extensively in trickling filters for water treatment; Material of construction, such as PVC, polypropylene, etc. is initially hydrophobic, but becomes fully wettable within 1-2 weeks.**
**Good mechanical strength and light weight.**
**Do not require grids for support and can rest on beams.**
**Specific area varies 48 – 120 $ft^2/ft^3$**
**Void fraction: 95 – 98%; Low bulk density.**
**<u>Disadvantages</u>: Poor distribution of water in biofilters, since water flow rate is significantly less than trickling filters or gas absorbers; High gas phase mass transfer resistance, due to large openings and laminar flow of gas.**

# PRD TECH'S SYNTHETIC BIOMEDIA
## General Considerations

1. Designed specifically for biofilters
2. Surface modified to allow accelerated attachment and growth of biofilms
3. Low bulk density; easily supported (2.5 – 7.0 $lb/ft^3$)
4. High biologically-active surface area (30 – 110 $ft^2/ft^3$)
5. Designed for good distribution of high gas flows and low liquid flow rates
6. Randomly packed or Structured, depending on application

# PRD TECH'S SYNTHETIC BIOMEDIA

1. **Randomly Packed Media (1", 2", 3", 3.5" in size)**

   - For very large biotrickling filters
   - Surface modified to allow biofilm attachment and growth
   - Size depends on gas BOD; High BOD – large size Low BOD – small size; Different sizes are used within the same biofilter
   - Low gas pressure drop and low bulk density

2. **Fibrous Media**

   - Used in final stages for polishing of low BOD gas
   - Acts as a mist eliminator also
   - Surface tailored for each application

# PRD TECH'S SYNTHETIC BIOMEDIA

3. **Structured Media**

- **Used for very high gas BOD applications**
- **Acts like a support structure also for other media types**
- **low bulk density; has to be cut to size**
- **low gas pressure drop**
- **Surface modified for each application to enable good attachment and growth of biofilm**

**Anyone or all three types of biomedia may be used in a single PRD Tech's Biotrickling filter system, depending on gas BOD, flow rate, types of contaminants and operating conditions.**