

What to Look for in Gas-Phase Media.

Background:

Surprisingly light concentrations (ppb to ppt) of pollutant molecules make indoor air unattractive. Carried in an air stream, these molecules “experience” a gas-phased HVAC filter for a few milliseconds. Short “windows of opportunity” results in molecules collecting only on the adsorbent’s outer surfaces. Hence, surface structures deeper than a fraction of a micron from the outer surface are wasted. Adsorbent filters offering insufficient outer surface area (outerSA) function poorly. Obviously, the challenge is to produce media containing adsorbent which is entirely outerSA.

OuterSA determines performance:

granular activated carbon (GAC)	Gray Matter® adsorbent
mass: 0.05 mg	0.05 mg
granule diameter: 1 mm (1,000 microns)	0.0001 mm (0.1 micron)
USmesh: 25	250,000
number of granules: 1	1,000,000,000,000
innerSA + outerSA: 60,000 mm ²	60,000 mm ²
outerSA: 6 mm ² ()	60,000 mm ² (the area of this page)
outerSA density: 120 mm ² / mg	1,200,000 mm ² / mg

How much GAC is required for to match GM’s outerSA?

The extraordinary large amounts of GAC required explain why such filters aren’t produced.

filter type:	GM® adsorbent		GAC, 1 mm	
	grams	pounds	grams	pounds
24”x24” panel	0.04	0.00075	4,000	7.5
1” 24”x24” pleated	0.08	0.0015	8,000	15
2” 24”x24” pleated	0.16	0.003	16,000	30
4” 24”x24” pleated	0.32	0.006	32,000	60

Comparing GM® to other gas-phase media:

16 ft2 for 2"x24"x24" pleated filters:

MEDIA:	Gray Matter®	impregnated cloth	pellets	
color?	gray	black	black	no
price?	\$0.16 / ft2	\$0.30 / ft2	\$1.50 / ft2	no
weight?	1.8 oz / yd2	11 oz / yd2	18 oz / yd2	no
adsorbent content?	0.16 g	104 g	1900 g	no
odor-removal claims?	good	good	good	no
particle removal?	MERV 8	poor	poorer	yes
field performance?	goods	poor	poorer	yes
longevity?	months	weeks	days	yes
ADSORBENT:				
innerSA + outerSA?	192 m2	156,000 m2	2,700,000 m2	no
outerSA?	192 m2	13 m2 *	3 m2	yes
outerSA / g?	1200 m2 / g	0.125 m2 / g	0.0016 m2 / g	yes
price of outerSA / m2?	\$0.03 / m2	\$1.60 / m2	\$15.30 / m2	yes

* assumes glue does not plug outerSA

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