



Bio-Filtration/Scrubber Comparisons

Carbon Types

- Virgin Coconut Shell Carbon
 - Physical Adsorption
- Impregnated Carbon
 - Chemical Adsorption
 - KOH/NaOH Impregnated
 - KI Adsorption
- Catalytic Carbon
 - Catalytic Reaction
- Catalytic Water Washable Carbon

Catalytic Reaction

- Proprietary catalyst reacts to form element sulfur
 $2\text{H}_2\text{S} + \text{O}_2 = 2\text{S} + \text{H}_2\text{O}$
- Extremely high H₂S capacity
- No extreme temperature rise
- No dangerous waste generated

Carbon Scrubber Vessels

- Typical FRP/Steel Construction
- Standard Accessories
 - Fan/Blower
 - Ducting
 - Gauges
 - Grease/Mist Eliminator
 - Inlet/Outlet Damper
 - Media Sample Ports
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Typical Carbon Specification

Specifications

Carbon Tetrachloride Number (% minimum)	70
Iodine Number (minimum)	1000
Moisture (% maximum, as packed)	10
Hardness Number (Ball Pan, minimum)	95
Size (Particle Diameter, mm)	3,4

Typical Properties

Carbon Tetrachloride Number	70-80
Apparent Density (g/ml)	0.44 – 0.50
Bulk Density (lb/ft ³)	28 – 31
Hardness Number (Ball pan)	95 – 99
Mean Particle Diameter (mm): 4 mm	3.7 – 4.0
H ₂ O Minimum Breakthrough Capacity (gm H ₂ O/cc carbon)	0.25 – 0.30

Basis for Cost Analysis

Carbon Scrubber Capacity (ft ³) (4 – 8' Dia Tanks x 3' Carbon depth & 50 ft/min bed velocity)	600
Carbon Density (g/cc)	0.46 - 0.58
Carbon Scrubber Capacity (lb)	17250 - 46,000
Carbon Cost (\$/lb)	\$1.50 - \$3.00
Initial H ₂ S Capacity (g/cc)	0.25 - 0.09
Number of Regeneration Cycles per Carbon Life	5
H ₂ S Capacity over Carbon life (g/cc)	0.25
Number of Carbon Replacements over 10 yrs	2
Regeneration Cycles over 10 yrs	N/A-10
Replacement Carbon Cost	\$1.50 - \$3.00
Carbon Change-out & Disposal Cost	\$0 - \$5,000
Regeneration Labor & Water Cost	\$0 - \$3,000
Wastewater Neutralization & Disposal from Washing	\$0 - \$2,500

Carbon Capital & Operation Costs

Cost Analysis

Initial Carbon Cost	\$25,000 - 63,000
Carbon Change-out & Disposal	\$0.00 - \$10,000
Replacement Carbon Cost	\$0.00 - \$126,000
Regeneration Labor & Water Cost	\$0.00 - \$30,000
Wastewater Disposal from Carbon Washing	\$0.00 - \$25,000
Total Operating Cost per bed over 10 yrs	\$0.00 - \$254,000

Traditional Carbon Cost Comparison

Odor Control Carbons	Density	Weight	H2S Removal	H2S Removed	Relative Cost	H2S Removed
	g/cc	lbs/ft ³	g/cc	% of wt	\$/lb	\$/lb
Coconut Shell Carbon	0.5	31	0.05	10.0%	\$1.00	\$10.00
Caustic Impregnated Carbon	0.55	34	0.14	25.4%	\$1.00	\$3.94
Catalytic Water Wash Carbon	0.56	35	0.09	16.1%	\$3.00	\$18.63
Catalytic High Capacity Carbon	0.46	29	0.25	54.5%	\$2.00	\$3.70

Traditional Carbon Scrubber Design Parameters

❖ Flow Rate	1,000 to 30,000 cfm
❖ Pressure Drop	5 to 15 inches H ₂ O
❖ Superficial Velocity	25 to 50 ft/min
Flow Rate (ft ³)/GAC Bed Surface (ft ²)	
❖ Loading Rate	Up to 50 percent
❖ Temperature	Less than 125 F
❖ Relative Humidity	Up to 100 Percent
❖ Bed Depth	3 to 5 ft
GAC Volume (ft ³)/CAC Bed Surface (ft ²)	
❖ Bed Diameter	3 to 12 ft

BASIS FOR COST ANALYSIS

ITEM	Units	CALGON CENTAUR HSV	CEC TYPECEV-4C	FILTERCROBE I [®]
Carbon Scrubber Capacity	ft ³	600	600	680
Carbon Density	g/cc	0.56	0.46	0.56
Carbon Scrubber Capacity	lb.	21,000	17,250	46,314
Carbon Cost	\$/lb.	\$3.00	\$1.50	\$1.95
Initial H ₂ S Capacity	g/cc	0.09	0.25	0.09
Regeneration Cycles per Carbon Life	No.	5	NA	NA
H ₂ S Capacity over Carbon life	g/cc	0.25	0.25	NA
Carbon Replacements over 10 yrs.	No.	2	2	NA
Regeneration Cycles over 10 years	No.	10	NA	NA
Replacement Carbon Cost	\$	\$3,000	\$1,500	NA
Carbon Change-out & Disposal Cost	\$	\$5,000	\$5,000	NA
Regeneration Labor & Water Cost	\$	\$3,000	NA	NA
Wastewater Neutralization & Disposal from Washing	\$	\$2,500	NA	NA

CARBON CAPITAL OPERATION COST

ITEM	CALGON CENTAUR HSV	CEC TYPECEV-4C	FILTERCROBE I [®]
Initial Carbon Cost	\$63,000	\$25,875	\$46,314
Carbon Change-Out & Disposal Cost	\$10,000	\$10,000	-0-
Carbon Replacement	\$126,000	\$51,000	-0-
Regeneration Labor & Water	\$30,000	NA	NA
Wastewater Disposal From Carbon Washing	\$25,000	NA	NA
Microbes	NA	NA	\$7,200
10 YEARS			
Total Operating Cost Per Unit	\$254,000	\$86,875	\$53,514
Total Savings Per Unit	-	\$167,125	\$200,486
20 YEARS			
Total Operating Cost Per Unit	\$508,000	\$173,750	\$107,028
Total Savings Per Unit	-	\$334,250	\$400,972

CARBON COST COMPARISON

Odor Control Carbons	Density	Weight	H ₂ S Removal	H ₂ S Removed	Product Cost (Approx)	H ₂ S Removed per lb of Spent Carbon
	lbs/cc	lbs/ft ³	g/cc	% of Wt	\$/lb	\$/lb
Coconut Shell Carbon	0.5	31	0.05	10.00%	\$1.00	\$10.00
Caustic Impregnated Carbon	0.55	34	0.14	25.40%	\$1.00	\$3.94
Water Washable Catalytic Carbon	0.56	35	0.09	16.10%	\$3.00	\$18.63
CEV-4C High Capacity Catalytic Carbon	0.46	29	0.25	54.50%	\$2.00	\$3.70
Filtercrobe I [®]	0.56	35	0.09	109%	\$1.95	\$0.90*

*Note based on a 20 year period.

For more information about GAC systems and there usage, please contact American Environmental Fabrication & Supply +1 918 708-1253 or visit the web page at www.american-environmental.us