Smart Sponge® Plus

Last Line of Defense to Fight Microorganisms

AbTech's Smart Sponge®

AbTech Industries, Inc. has developed a patented technology over the past seven years based on a proprietary blend of synthetic polymers aimed at removal of hydrocarbons and oil derivatives from surface water. AbTech's process creates a porous structure (see Figure A) with hydrophobic and oleophilic characteristics capable of selectively removing hydrocarbons while allowing high flow rates. This structure is highly porous; as hydrocarbons are absorbed into its structure, the Smart Sponge® swells and maintains porosity and filtering capabilities.

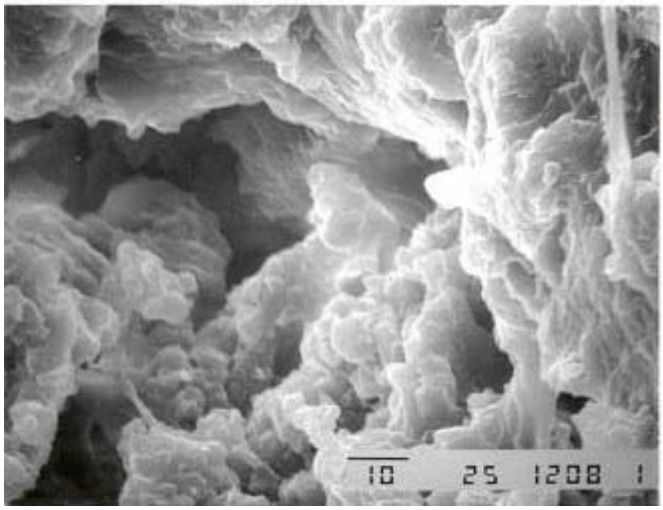
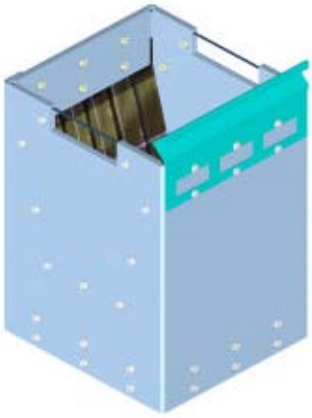


Figure A (X 1,000)



UUF CO1414N

Field and laboratory tests have confirmed the Smart Sponge® capability to absorb, depending on the type of oil contaminant, up to five times its own weight and remove 70% to 95% of the hydrocarbons present in stormwater runoff, typically in the range of 5 to 30 mg/litre (ppm). The absorption is permanent and the saturated product does not leach or leak contaminants (see Attachment 1: TCLP Test Benzene), transforming the contaminant – in most cases – into a solid waste with lower disposal costs.

AbTech Smart Sponge® Technology is applied in a range of products, primarily the Ultra-Urban® Filter (UUF), a catch basin insert capable of removing sediment, trash, debris and hydrocarbons from stormwater runoff.

Smart Sponge® Plus

Over the past 18 months, AbTech Industries has worked on the development of a new solution capable of treating micro-organisms as well as hydrocarbons named Smart Sponge Plus. Abtech has developed a technology capable of binding an Antimicrobial Agent to its proprietary polymers thereby modifying their surface and adding micro biostatic features while maintaining the oil absorbing capabilities (see Figure B).

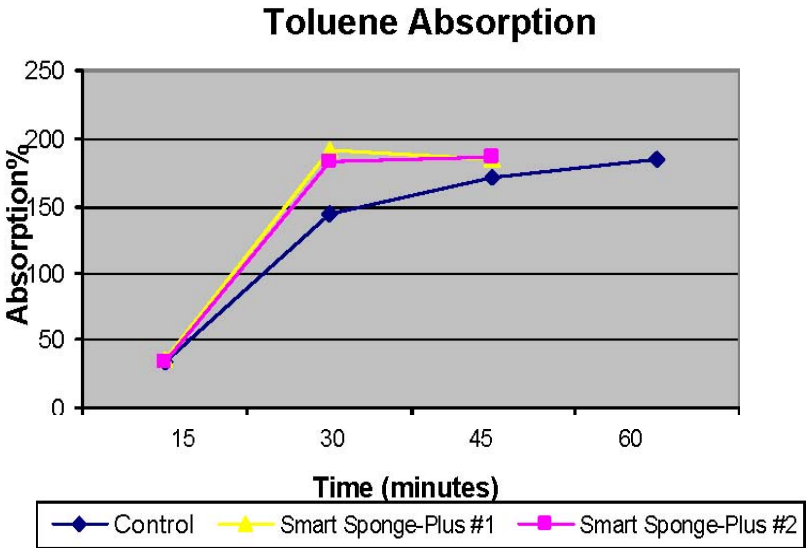


Figure B

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Smart Sponge® Plus Contd.

The Agent used for this innovative technology is an Organosilane derivative (see its chemistry in Figure C), which is widely used in a variety of fields including medical, consumables, pool equipment and consumer goods.

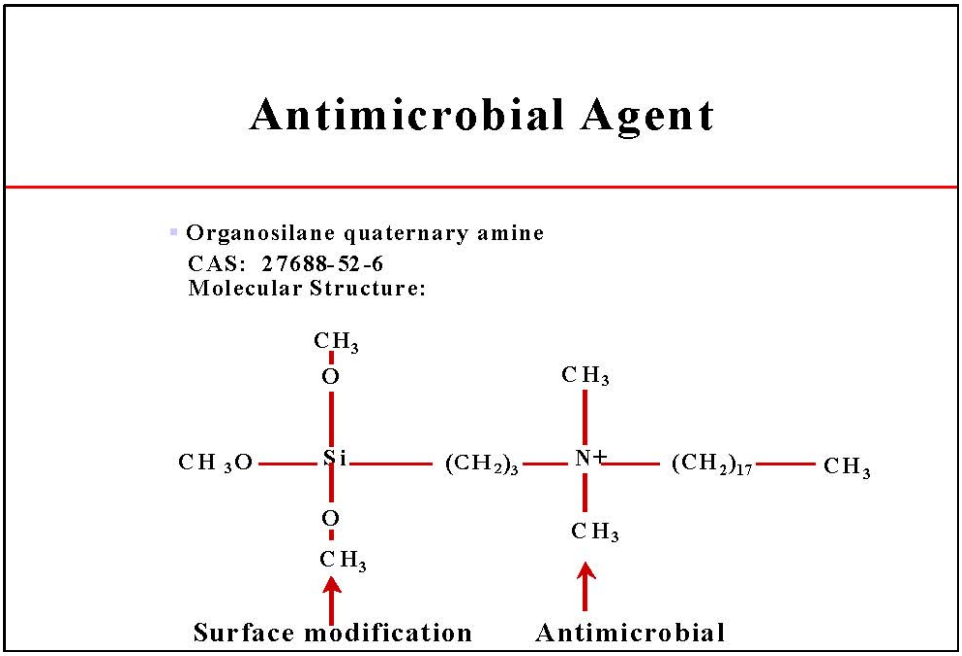

Figure C

Its mode of action is very simple (no Chlorine or heavy metals involved) and in surface bound applications it neither introduces chemicals into the treated water nor produces toxic metabolites. Its chemical structure ensures long-term stability to natural agents and reduced degradation. This Antimicrobial Agent is registered with the USA EPA for various applications and has been proven successful in those applications against several micro-organisms (see Figure D).

Tested Positively on:

- **Aspergillus Niger**
- **Trychophyton Mentagrophytes**
- **Penicillium Pinophilum**
- **Chaetomium Globosum**
- **Trichoderma Virens**
- **Aureobadisium Pullulans**
- **Staphylococcus Aureus**
- **Escherichia Coli**
- **Pseudomonas Aeruginosa**
- **Candida Albicans**
- **Salmonella**
- **Klebsiella Pneumoniae**

Figure D

In the Smart Sponge® Plus, the Antimicrobial Agent is chemically and permanently bound to the polymer surface and it does not leach or leak, therefore avoiding any downstream toxicity issues – toxicity Tested on Ceriodaphnia, Selenastrum and Fathead Minnow. The antimicrobial mechanism is based on the Agent's electromagnetic interaction with the micro-organism cell membrane, causing the micro-organism disruption (see Figure E), but no chemical or physical change in the agent. Antimicrobial activity does not reduce the agent capability or cause its depletion and, therefore, maintains long-term effectiveness.

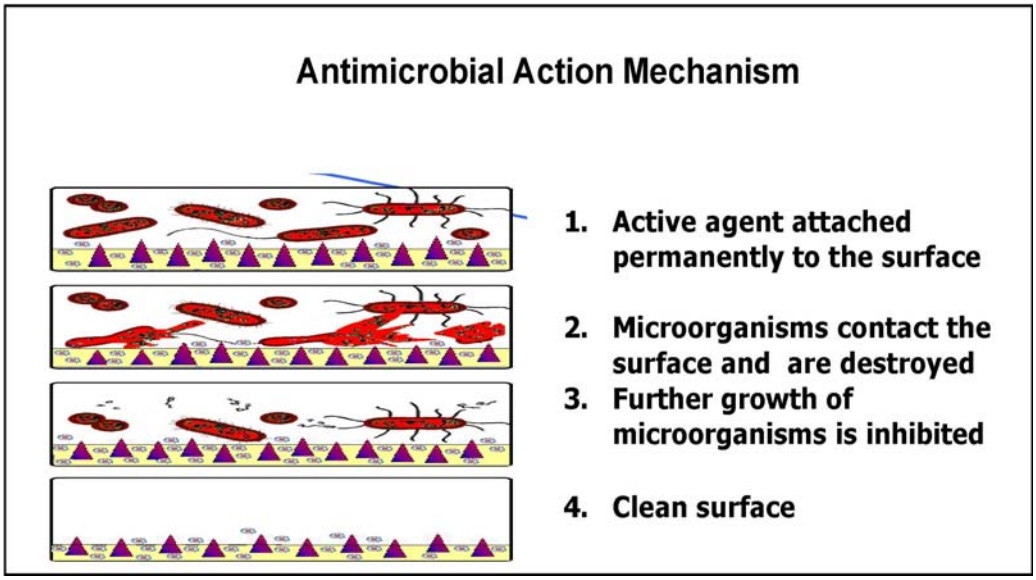

Figure E

Smart Sponge® Plus internal laboratory efficiency testing has verified its micro biostatic effectiveness with E.coli (see Figure F).

Microbiological Analysis	
AbTech Smart Sponge®	**Bacterial (% Reduction) 1 hour**
ACX10P	0%
ACX10P-Plus-AEG	>99.99%
ASTM E2149-01 "Dynamic Shake Flask" 1 g sample 50 ml 0.3 mM KH_2PO_4 solution $1x10_5$ E.coli/ml 0.01% Q2-5211 wetting agent	

Figure F

Additional internal laboratory testing in dynamic settings (in-line filtration) was performed in order to simulate stormwater runoff conditions. Figure G outlines the microbial reduction capabilities of the Smart Sponge® Plus with Staphilococcus Aureus and E.coli.

Product	Gen.	Contact Time	Microorganism	Reduction %
Control	-	15 sec.	Staphil. Aureus	16
SMSP-ACX10N-Plus	I	15 sec.	Staphil. Aureus	46
SMSP-ACX10N-Plus	II	15 sec.	Staphil. Aureus	65
SMSP-ACX10N-Plus	II	15 sec.	Escherichia Coli	55
Control	-	20 sec.	Staphil. Aureus	39
SMSP-ACX10N-Plus	II	20 sec.	Staphil. Aureus	83

Figure G

Smart Sponge® Plus will also perform as a fungi static, odour and mildew control and will be featured in existing and future UUF-Plus catch basin inserts for stormwater runoff treatment.

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