



## **IRREVERSABLE LOSS OF WATER RETENTION**

Dr. Robert Isaiah Brooks, PhD

As moisture is removed from a cellulosic substance, such as peat, the cellulosic hydroxyls bond together. This is true for water removed by pressing or by drying with heat. The bonding that occurs is generally called hydrogen bonding. At higher moisture levels this hydrogen bonding can be reversed by slurring the peat in water. But as the peat is dried further, the hydrogen bonding becomes so dense that the cellulose molecules become irreversibly bonded together. This is shown in Figure 1. This is a lab study of the effects of the wet pressing of peat in the Wright Brothers screw press. A peat sample pressed to 80% water, 20% peat, was furthered dried in a lab microwave oven. You can see that we have an inflection point at about 35% water, 65% peat. At this point we start getting irreversible hydrogen bonding. At 10% water, 90% peat, the inflection is severe, and we have considerable irreversible bonding. This was demonstrated by putting each sample in a lightly stirred dilute slurry for 24 hours to retrieve as much water of hydration as the sample would hold.

### **Testing Results**

Two different peat samples are tested for water retention. The Wright Brothers AmeriZorb sample started at 67% water, 33% peat. The Canadian peat sample started at 50% water, 50% peat. The history of the Canadian peat sample is unknown. It was probably dried to near 10% water, 90% peat as manufactured. Peat this dry is strongly hydrophilic and will tend to gain moisture as it sets around. At any rate, Figure 2 shows a marked difference between the two samples in their ability to hydrate. The Canadian peat is much less hydrophilic than is the Amerizorb. The Canadian peat may be somewhat less hydrophilic in its natural state, but over drying is largely the cause of the much reduced water retention. As peat is dried to about 30% water it starts to undergo an irreversible loss in water retention caused by irreversible hydrogen bonding of the cellulose molecules. At 10% water this effect is severe.



## ABSORPTION CONTROL

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### Testing Conclusion

AmeriZorb is clearly superior to other products available for adsorbing liquids from a highway collision. There are three primary factors to be considered.

1. Initial absorption of AmeriZorb Throw & Go Peat is superior. It simply does a more complete job of absorbing liquids and attaching nutrients.
2. Throw & Go Peat, due to higher moisture content, is easily hydrated. Dry absorbents have to be spread onto the spill and then made to contact the spill fluids. AmeriZorb lays down on and in the spill without the forced contact. AmeriZorb is superior in this regard.
3. Spill fluids are bonded more tightly to AmeriZorb. This is vital as absorbents either get left at scenes or are collect and disposed of.

Release of the absorbed spill fluids in a landfill and beside the road is of major importance

With its very active hydrogen bonding capability, and it's very considerable available bonding surface, AmeriZorb hangs on tightly to spill fluids.



### ABSORPTION SURFACE AREA

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The two major factors that define AmeriZorb's capacity for liquid adsorption are hydrogen bonding and surface area. The surface area available for liquid adsorption is very different among the various adsorbents/absorbents used commercially for highway spill cleanup. Peat adsorbents/adsorbents have considerably more surface available for liquid adsorption than other adsorbents. Nitrogen gas adsorption studies have established that about one gram of cellulose has an accessible surface area of one and one half square meters. True, this is gas adsorption rather than liquid. But it does establish that there is a lot of surface area available for adsorption/adsorption in peat.

More adsorbent surface area available means better adsorption. This is reflected in both better initial adsorption and better fluid retention over time. Below are some lab test results on relative adsorption by weight percent.

	AmeriZorb	Rice hulls & ash	Street Sweep (kitty litter)
Water	129	85	78
Antifreeze	147	83	67
Gasoline	118	82	55
Diesel	135	80	63
Motor oil (10-30)	124	79	69

With water and antifreeze the AmeriZorb hydrogen bonding is significant. With gasoline, diesel and motor oil it is more the adsorbent surface area. And as the peat moisture is lowered to below about 25%, we are irretrievably losing both hydrogen bonding and adsorption surface area. AmeriZorb is clearly the best product available for highway spill cleanup.