



© 2010 BioLargo, Inc.

## Technical Product Claims

### Identification

BI<sub>2</sub>O-SORB™, ZD-SORB™ and CupriDyne™ are trademarks of BioLargo Inc. The technology component is identified on labels and correspondence by contract with distributors and licensees.

### Safe Harbor Disclosure

The BioLargo, Inc. company is classed by the Food and Drug Administration as a “Component Manufacturer” so that the data offered herein contributes to the product claims of retailers by inference, only, and that the actual experience of users may differ from the fundamental claims of the components according to a wide variation of conversions and deployments of the sorbent webs which have not been specifically studied.

For overall safety reasons, the underlying technology follows the published requirements of the FDA for dosage levels to be effective, and utilizes chemicals which are Generally Regarded as Safe (GRAS), all as published by them in the 21 CFR.

#### BioLargo Technologies Inc. Safety References, Reagents and Products

Chemical	CAS Reg. No.#	Federal Code	Safety Level
Copper Sulfate	7758-98-7	21CFR184.1261	GRAS
Potassium Iodide	7681-11-0	21CFR172.375	GRAS
Cupric Iodide	7681-65-4	21CFR184.1265	GRAS
Dosage Level Allowed	p. 332 ff.	21CFR178.1010	4/01/98

### Guide to the Disclosures

The third party studies discussed herein establish the following table of claims:

Technology Value-Added Features					
Feature			Quantity	Third Party*	Method Reference(s)
Absorbency, Saline g/g			28.0 ± 4.0	MTS	IST 10.1, EDANA 10.1.72, ASTM D1117-95
Rewet Relative Holding Power			6x	MTS	GATS (Gravimetric Absorbency Testing System)
Airlaid Physical Properties			as discussed	MTS, BSI	IST 120.1 (ASTM D5729, ASTM 5736)
Antimicrobial Properties			3-11 log 10 kill	ARC	ASTM Subcommittee E35, E1054-02
GLP Efficacy Testing, Diapers			>3 log 10 kill	ATS	CGT-4100, ASTM
Thermal Conductivity Resistance			R3.9-R4.5 per inch	ISC	ASTM, ISTA and U.N./IATA Dangerous Goods Cert'd
* MTS, Marketing Technology Service, Kalamazoo, MI 49009					
BSI, Blood Systems Inc, Scottsdale, AZ 85257					
ARC, Alberta Research Council, Edmonton, AB T6H 5X2					
ATS, ATS Labs Inc., Eagan, MN 55121					
ISC, Insulated Shipping Containers, Phoenix, AZ 85043					



© 2010 BioLargo, Inc.

## Chemical Considerations

### CupriDyne-LR® Tests 2006-2008

CupriDyne-LR® is the BioLargo Life Technologies Inc. trademark of free-iodine generating technology held in US patents 6146725, 6328929, and several applications pending, which originates in the standard chemical reaction:



with several stoichiometric and reactant modifications. The hydration of any of the reactants is sufficient to produce purple iodine gas, and if accomplished in water, this iodine gas is soluble up to 337 ppm. Out-gassing occurs from Henry's Law ( $e^p = e^{kc}$ ).

Also in water, a Lugol ratio of  $\text{I}_2/\text{I}^-$  of 1:3 (CupriDyne-LR®) can be instantly achieved. Intermediary disinfection, characteristic of free iodine, is observed in third party expert testing.<sup>2 3 4</sup>

<sup>1</sup> After Schmeisser in *Handbook of Preparative Inorganic Chemistry*, Vol 1, G. Bauer, Ed., Academic Press, New York, 2<sup>nd</sup> ed., 1963, p. 275

CupriDyne-LR™, Suspension	Control, log10	Log10 Reduction			
		5min	10min	20min	30min
staph. Aureus, 20 ppm	6.049	0.040	0.100	0.081	0.086
staph. Aureus, 40 ppm	6.049	0.924	1.260	2.523	4.046
staph. Aureus, 80 ppm	6.049	2.046	1.770	3.000	5.301
klebsiella pneumoniae, 20ppm	6.283	-	0.242	0.324	0.754
klebsiella pneumoniae, 40ppm	6.283	5.046	5.301	5.301	5.301
<sup>2</sup> klebsiella pneumoniae, 80ppm	6.283	5.046	5.301	5.301	5.301

<sup>3</sup> All References © ATS Labs, Eagan, MN 55121: A suspension of bacterial cells is exposed to the sanitizer for a specified contact time. After exposure, an aliquot of the exposed suspension is transferred to vessels containing neutralizing subculture media and assayed for survivors. Appropriate numbers control, purity, sterility, viability, and neutralization controls are performed. The current version of Standard Operating Procedure CGT-4100 reflects the methods which shall be used in this study.

Test Organisms	ATCC #	Growth Medium	Incubation Parameters
<i>Escherichia coli</i>	11229	Nutrient Agar A & B	35-37°C, aerobic
<i>Staphylococcus aureus</i>	6538	Nutrient Agar A & B	35-37°C, aerobic

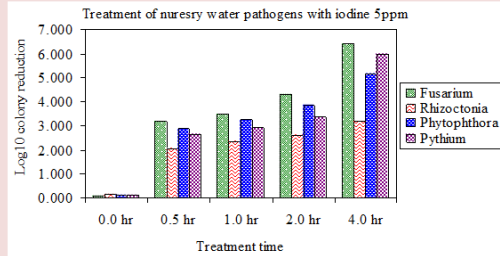
A film of bacterial cells dried on a surface of glass slide carriers is exposed to the test substance for a specified contact time. After exposure, the carriers are neutralized and assayed for survivors. Appropriate viability, sterility, purity, carrier quantitation and neutralization controls are performed. The current version of Standard Operating Procedure CGT-4150 reflects the methods which shall be used in this study.

Test Organisms	ATCC #	Growth Medium	Incubation Parameters
<i>Staphylococcus aureus</i>	6538	AOAC Nutrient Broth	35-37°C, aerobic
<i>Klebsiella pneumoniae</i>	4352	AOAC Nutrient Broth	35-37°C, aerobic

<sup>4</sup> Note: CupriDyne™ mist is NOT a hard surface disinfectant (results = 97.5% reduction against a required 99.9% at 5 minutes contact time); CupriDyne-LR™ qualifies. Contact times >10 minutes are required at the allowed dosage of 20-80 ppm as  $\text{I}_2$  (21 CFR §178.1010). The standard EPA approved method tests for solvation of the biofilm in addition to the reduction of species.



Laboratory Suspension and Field Screening Tests					
EPA Standard Laboratory Tests	Reference	Procedure	Contact Time	Dosage	Observation
SA, Staph. Aureus	1	Suspension, EPA Standard	5-30 min	20-80 ppm	>99.999%
SA, Staph. Aureus	1	Suspension, EPA Standard	30 seconds	80 ppm	<99.99%
MRSA, methacillin resistant SA	1	Suspension, EPA Standard	10-20 min	80 ppm	>99.999%
VRE, vancomycin resistant ent.	1	Suspension, EPA Standard	10-20 min	80 ppm	>99.3% - >99.999%
Klebsiella, pneumoniae	1	Suspension, EPA Standard	5-30 min	20-80 ppm	>99.999%
Enterobacter aerogenes	1	Suspension, EPA Standard	5 min	80 ppm	>98.8%
E. Coli	1,2	Suspension, EPA Standard	5-30 min	20-80 ppm	>99.999%
E. Coli	1,2	Suspension, EPA Standard	30 seconds	80 ppm	<99.99%
Clostridium difficile (20% spores)	1	Suspension, EPA Standard	10-20 min	80 ppm	>99.995%, 4.5log10
Salmonella (S. seftenberg 2422, S. enteritidis 2632, S. typhimurium 2692 and 2746 and S. orienburg 2695)	5	Suspension, mixed species	60 seconds	30 ppm	>99.999%; 5.2log10
<b>Free Iodine Field Trials</b>					
			<b>Contact Time</b>	<b>Dosage</b>	<b>Observation</b>
Alta Research Council, e. coli + SAP	2	Gel Suspension	5 min	20 ppm	>99.999%
UCLA Manhattan Beach Sand, e. coli	3	Silica Sand Elution, UCLA	5 min	80 ppm	>99.999%
Adult Incontinence Diaper, e. coli	1	Elution, ATS Labs	10 min, 4 hours	80 ppm	>99.9%, >99.88%
Nematology, Prill Method	1	Suspension, EPA Standard	5 min	20 ppm	>99.999%
Nematology, Prill Method	1	In Situ Recovery, Oregon	21 Days	30 ppm	<90%, Differential Kill of Mutants
Nematology, Irrigation Method	1	In Situ Recovery, Switzerland	3 days	80 ppm	<90%, Undifferentiated
Pseudomonas syringae (tomato)	4	In Vivo (absorbed into plant pretreat)	10 days	30-300 ppm	<90%
Xanthomonas axonopodis (tomato)	4	In Vivo (absorbed into plant)	10 days	30-300 ppm	<90%
Erwinia amylovora (pear)	4	In Vivo (absorbed into plant)	10 days	30-300 ppm	<90%
Xanthomonas campestris (tomato)	5	post treatment	2 minutes	30-60 ppm	<99.99%; 3.36log10 red.
<b>Fungicidal, CupriDyne Spray</b>					
Alternaria solani (tomato)	4	Crop pretreatment by foliar spray	4-20 days	6-600 ppm	<99%, Persistently Preventative >80%
Phytophthora infestans (potato)	4	followed by infection at 500 l/ha	4-20 days	6-600 ppm	<99%, Persistently Preventative >80%
Plasmopara viticola (grape)	4	innoculum to both sides of leaf at	4-20 days	6-600 ppm	<99%, Persistently Preventative >80%
Uncinula necator (grape)	4	plus 2 days following treatment	4-20 days	6-600 ppm	<99%, Persistently Preventative >80%
Puccinia recondita (wheat)	4		4-20 days	6-600 ppm	<90%, Preventative >80% efficacy
Pyrenophora teres (barley)	4	water hardness > 140 ppm	4-20 days	6-600 ppm	<90%, Preventative >80% efficacy
Septoria tritici (wheat)	4		4-20 days	6-600 ppm	<90%, Indeterminate
Botrytis cinerea (tomato)	4		4-20 days	6-600 ppm	<90%, Indeterminate
Geotricum candidum	5	Suspension, from Oranges	60 sec	30 ppm	>99.998%; 4.62log10 red.
Penicillium digitatum	5	Suspension, from Oranges	60 sec	30 ppm	>99.88%; 1.92log10 red.
<b>Post Harvest Water Dip</b>					
Orange	5	Ambient STP;	1-4 minutes	10-30 ppm	<99% TBC; <99% TFC; 1.34-1.98log10 red.
Nectarine	5	As total bacterial or fungal spore count	dipping times	10-30 ppm	<99.9% TBC; <99% TFC; 1.67-2.28 log10 red.
Peach	5	non-species specific;		30 ppm	<99.9% TBC; <99% TFC; 1.26-2.90 log10 red.
Potato	5	no pretreatment		30 ppm	<90% TBC; <99% TFC; 0.07-1.39 log10 red.
Tomato	5	typical dirt/organic load, 0.5% w/w		20-30 ppm	<99% TBC; <90% TFC; 1.46-1.99log10 red.
Lettuce	5	hard water		30 ppm	<99% TBC; <99% TFC; 1.02-1.52log10 red.
Bean Sprouts	5			20-30 ppm	No counts: fresh looking at 6 days
Apple	5			20 30 ppm	<99.9% TBC; <99% TFC; 1.68 2.34log10 red.
Strawberry	5			30 ppm	<90% TBC; <99% TFC; 0.57-1.83log10 red.
Avocado	5			10-20 ppm	<90% TBC; <99.9% TFC; 0.96-2.19log10 red.
Rockmelon	5			30 ppm	<90% TBC; <99.9% TFC; 0.83-2.95log10 red.
Xanthomonas campestris pv vesicatoria (DAR34895) and X. c. pv vesicatoria (DAR73877)	5	Citrus Canker Surrogates; Swabs from Oranges	2 min	60 ppm	>99.9%; 3.41-3.63log10 red.
<b>Hydroponic Water Treatment</b>					
Fusarium semitectum	5	Selected time curves for persistent			
Rhizoctonia solani	5	level of 5 ppm free iodine;			
Phytophthora megasperma	5	systems are essentially sterile			
Pythium sclerotectum	5				



Reference Key	KEY	Source
	1	ATS-Labs, Eagan, MN
	2	Alberta Research Council, Edmonton, AB
	3	UCLA Dept of Civil Engineering, LA, CA
	4	Confidential NDA with Client, GBR
	5	Itoq PTY Ltd., US and AUS



© 2010 BioLargo, Inc.

## Chemical Kinetics of Free Iodine

The dissociation of iodine and formation of active chemical species in water is now well known:

Reaction	Type of Reaction	Equilibrium constant	Reference
$I_2 + H_2O \approx HIO + I^- + H^+$	(hydrolysis)	$k = 5.4 \times 10^{-13}$	Burger & Liebafsky 1973
$HOI \approx OI^- + H^+$	(hypoiodous acid dissociation)	$k = 4.0 \times 10^{-11}$	Bichsel & von Gunten 2000
$3HIO \approx IO_3^- + 2I^- + 3H^+$	(disproportionation of HOI)	$k = 2.5 \times 10^{-11}$	Gottardi 1978
$3I_2 + H_2O \approx IO_3^- + 5I^- + 6H^+$	(iodate formation)	$k = 4 \times 10^{-48}$	Bell & Gelles 1951
$I_2 + I^- \approx I_3^-$	(triiodide formation)	$k = 724$	Burger & Liebafsky 1973

A selection of inactivation curves follows from this literature on the subject:

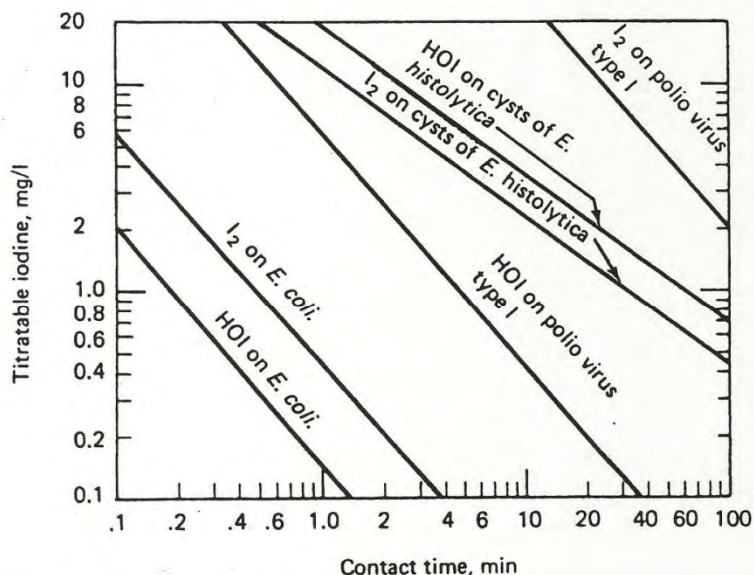


Fig. 1 Time versus concentration relationship in the destruction (99.0) of cysts, viruses and bacteria by  $I_2$  and HIO at 18°C.

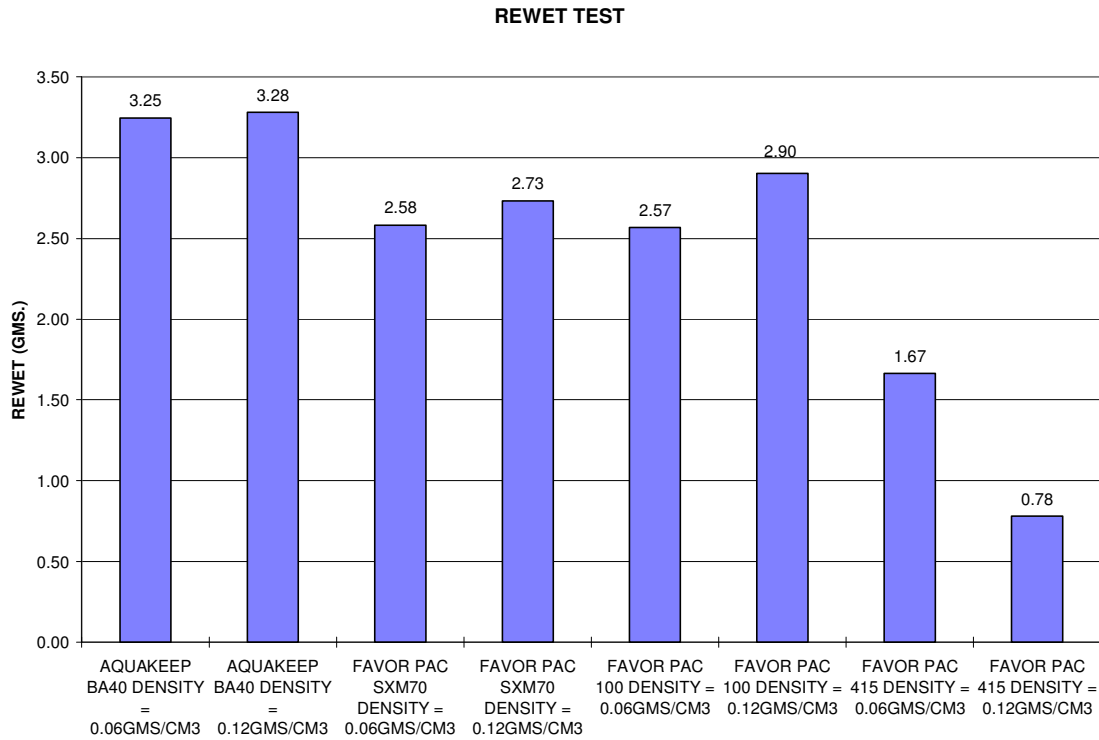
Strategically, formulators concentrate on shifting chemical equilibria toward production of free iodine,  $I_2$ , and thereby maximize the oxidative inactivation of target species.



### MTS Study (MTS Marketing Technology Services Inc., Kalamazoo, MI)

A study (with >10 replicates) of absorption with blood, water, and blood products was submitted to multiple regression to determine the quantity and interrelationships among fluid type (blood (“-B” or saline(“-S”)), superabsorbent types and manufacturers, web densities, pressures under load( 0.1,3 & 5 kPa), and rewet characteristics (holding power of absorbents).

The first important result is that saline studies correlate<sup>5</sup> to blood at the 99% level which establishes that testing for quality control purposes at the absorbent web factory may be undertaken with the more hygienic saline substitute for blood.



The chemical reaction products in combination (FAVOR PAC 415) with FDA approved superabsorbents for food service are responsible for significantly enhanced (6:1) holding power of blood and saline within the absorbent webs.

Superabsorbency (>10 g/g insult/absorbent weight) is established for all blood and blood products, including cold-concentrated red blood cells, between 4°C and 22°C, under all load pressures up to 5 kPa.

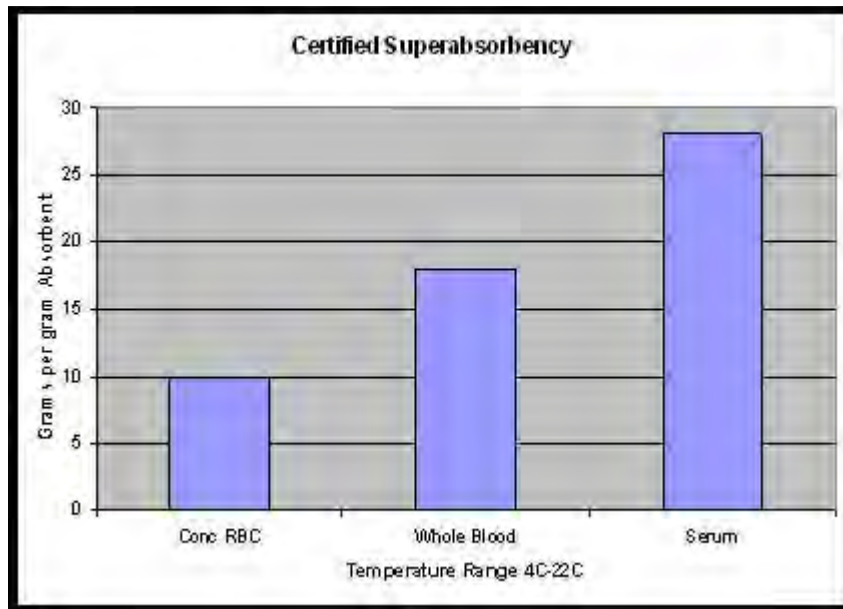
<sup>5</sup> See Appendix A, “Absorption Correlation Matrix”



© 2010 BioLargo, Inc.

### BTI Pak 415 Superabsorbents

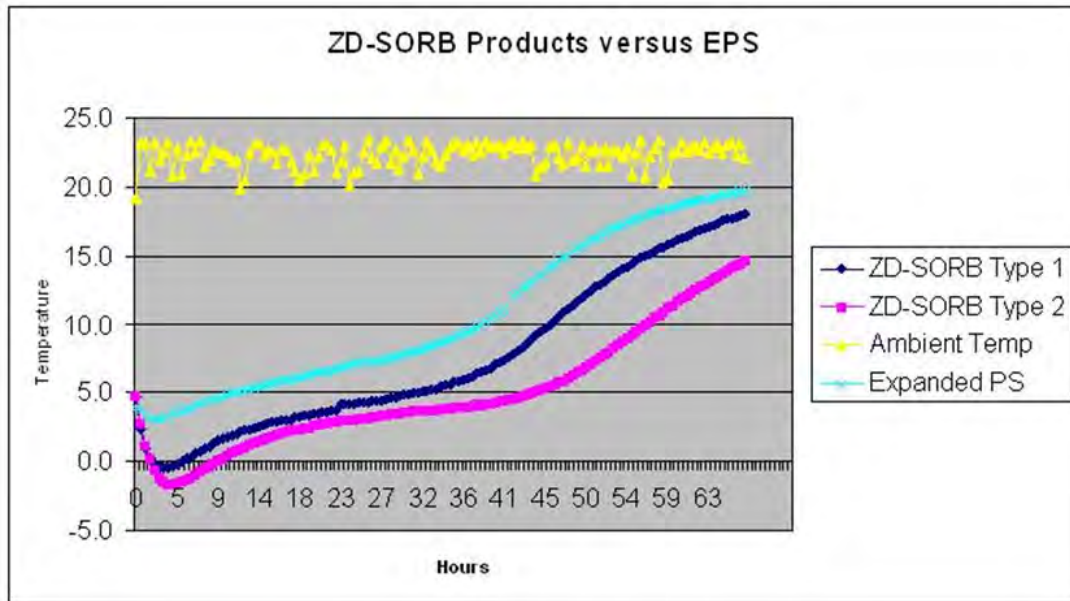
Feature	Minimum	Maximum
Absorbency, g/g, Saline	15	18
Absorbency, g/g. Blood	18	22
Acquisition Temperature, degC	4	20
Acquisition Pressure Loads, kPa	0.1	5
Basis Weights, gsm	70	1000
Density g/cm <sup>3</sup>	0.06	0.12
Formulary		
SAP Loading	15%	30%
Tensile Dry, J/M <sup>2</sup>	35	70
Tensile Wet, J/M <sup>2</sup>	14	27
Mordants/Iodine Content ppm	2	20



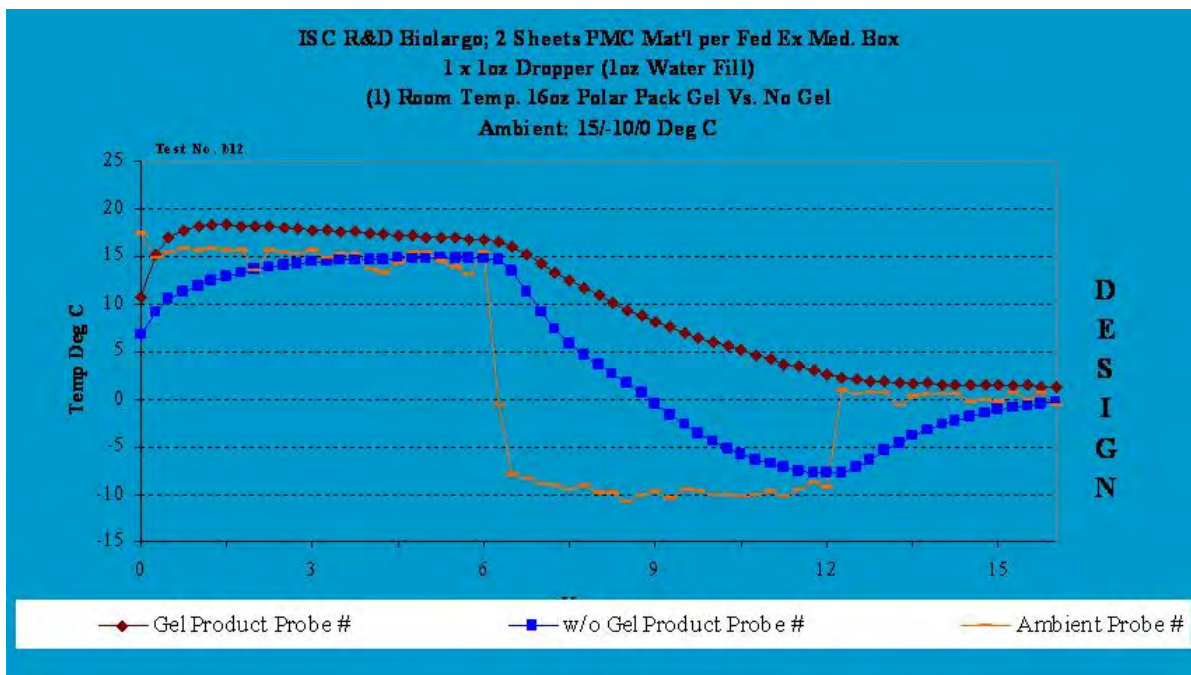
**Insulation Characteristics (Insulating Shipping Containers, Phoenix, AZ, 2002)**  
BioLargo Technologies Inc. superabsorbent products were also tested for superior insulating characteristics compared to expanded polystyrene (EPS) when the sorbent products were deployed as side-wall insulation in packaging.



© 2010 BioLargo, Inc.



Inclusion of microencapsulated phase changing materials in the absorbent products results in further multiplication of R-value.





© 2010 BioLargo, Inc.

## Appendix A, Absorption Study Correlation Matrix

Correlations

		TYPE	DENSITY	Abs0.1-S	Abs3.0-S	Abs5.0-S	Rewet-S	Abs0.1-B	Abs3.0-B	Abs5.0-B	Rewet-B
TYPE	Pearson Correlation	1.000	.000	-.409**	-.179	-.058	-.850**	-.196	-.469**	-.456**	.132
	Sig. (2-tailed)	.	1.000	.000	.113	.609	.000	.182	.001	.001	.323
	N	80	80	80	80	80	80	48	48	48	58
DENSITY	Pearson Correlation	.000	1.000	-.188	-.150	-.152	-.052	-.441**	.038	.047	-.408**
	Sig. (2-tailed)	1.000	.	.095	.185	.179	.645	.002	.798	.750	.001
	N	80	80	80	80	80	80	48	48	48	58
Abs0.1-S	Pearson Correlation	-.409**	-.188	1.000	.952**	.905**	.502**	.639**	.884**	.876**	.080
	Sig. (2-tailed)	.000	.095	.	.000	.000	.000	.000	.000	.000	.550
	N	80	80	80	80	80	80	48	48	48	58
Abs3.0-S	Pearson Correlation	-.179	-.150	.952**	1.000	.988**	.328**	.637**	.887**	.883**	.092
	Sig. (2-tailed)	.113	.185	.000	.	.000	.003	.000	.000	.000	.493
	N	80	80	80	80	80	80	48	48	48	58
Abs5.0-S	Pearson Correlation	-.058	-.152	.905**	.988**	1.000	.222*	.629**	.874**	.869**	.085
	Sig. (2-tailed)	.609	.179	.000	.000	.	.048	.000	.000	.000	.525
	N	80	80	80	80	80	80	48	48	48	58
Rewet-S	Pearson Correlation	-.850**	-.052	.502**	.328**	.222*	1.000	.216	.481**	.477**	.010
	Sig. (2-tailed)	.000	.645	.000	.003	.048	.	.139	.001	.001	.939
	N	80	80	80	80	80	80	48	48	48	58
Abs0.1-B	Pearson Correlation	-.196	-.441**	.639**	.637**	.629**	.216	1.000	.844**	.834**	.440**
	Sig. (2-tailed)	.182	.002	.000	.000	.000	.139	.	.000	.000	.002
	N	48	48	48	48	48	48	48	48	48	48
Abs3.0-B	Pearson Correlation	-.469**	.038	.884**	.887**	.874**	.481**	.844**	1.000	.998**	.211
	Sig. (2-tailed)	.001	.798	.000	.000	.000	.001	.000	.	.000	.151
	N	48	48	48	48	48	48	48	48	48	48
Abs5.0-B	Pearson Correlation	-.456**	.047	.876**	.883**	.869**	.477**	.834**	.998**	1.000	.230
	Sig. (2-tailed)	.001	.750	.000	.000	.000	.001	.000	.000	.	.116
	N	48	48	48	48	48	48	48	48	48	48
Rewet-B	Pearson Correlation	.132	-.408**	.080	.092	.085	.010	.440**	.211	.230	1.000
	Sig. (2-tailed)	.323	.001	.550	.493	.525	.939	.002	.151	.116	.
	N	58	58	58	58	58	58	48	48	48	58

\*\* Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (2-tailed).



© 2010 BioLargo, Inc.

## 2009 Field Potato Trials in Idaho



Table 5. Effect of foliar fungicide programs on the percentage of US#1 tubers, tubers over 10 oz, and dollar return per acre based on mock processing and fresh pack contracts (cv. Western Russet; Acequia, ID 2009).

Trt	Foliar applications				% US#1 Tubers	% Tubers > 10 oz	Dollar return/acre	
	Jul 1	Jul 11	Jul 24	Aug 7			Processing	Fresh
1					77 a	16 a	1798 d	2963 d
2	Endura + R	Headline + P	Endura + R	Dithane	83 a	26 a	2210 ab	3703 ab
3	Iodine (20%)	Iodine (20%)	Iodine (20%)	Iodine (20%)	82 a	21 a	2096 bc	3389 bc
4	Iodine (80%)	Iodine (80%)	Iodine (80%)	Iodine (80%)	84 a	23 a	2076 bc	3487 abc
5	Iodine (300%)	Iodine (300%)	Iodine (300%)	Iodine (300%)	81 a	21 a	1958 cd	3219 cd
6	Endura + W	Headline + W	Endura + W	Dithane + W	85 a	23 a	2354 a	3810 a
7	Quadris	Revus Top + P	Quadris Opti	BWS	87 a	22 a	2202 ab	3602 ab
8	Evito + Omega	Dithane	Evito + Omega	Dithane	84 a	28 a	2188 ab	3762 a
9	Evito + Omega	Chlorothalonil	Evito + Omega	Chlorothalonil	86 a	29 a	2165 b	3592 ab
10	Gavel	GWN + BWS	Gavel	GWN + BWS	83 a	28 a	2193 ab	3736 a
11	GWN + BWS	GWN + BWS	GWN + BWS	Gavel	84 a	25 a	2227 ab	3759 a
LSD (P=.10)					5.1	8.7	185.7	327.3
Standard Deviation					4.3	7.3	154.8	272.7
CV					5.12	30.44	7.26	7.69
Grand Mean					83.28	23.87	2133.3	3547.27
Treatment Prob(F)					0.2185	0.3910	<b>0.0025</b>	<b>0.0023</b>

Endura + R = Endura at 5.5 oz/a combined with the methylated seed oil Rivet at 0.5% v/v; Headline + P = Headline at 6 oz/a combined with the non-ionic surfactant Preference at 0.25% v/v; Dithane = Dithane F-45 at 1.6 qt/a; Iodine = CupriDyne BI20 at 20, 80, and 300 % active ingredient/volume spray mix; Endura + W = Endura at 5.5 oz/a combined with the wetting agent Wetcit at 48 fl oz/100 gal; Headline + W = Headline at 6 oz/a combined with the wetting agent Wetcit at 48 fl oz/100 gal; Dithane + W = Dithane F-45 at 1.6 qt/a combined with the wetting agent Wetcit at 48 fl oz/100 gal; Quadris = 6 fl oz/a; Revus Top = 5.5 fl oz/a combined with Preference at 0.25% v/v; Quadris Opti = 1.6 qt/a; BWS = Bravo WS at 1.5 pt/a; Evito = 2.0 oz/a; Omega = 6 oz/a; Chlorothalonil = Chlorothalonil at 1.5 pt/a; Gavel = Gavel at 2 lb/a; GWN = GWN 4700 at 3 oz/a.

Mean comparisons performed only when ANOVA Treatment Prob(F) is significant at the pre-determined mean comparison level (<0.10). Significant values are bolded. Means followed by same letter do not significantly differ (P=0.10, LSD).

Free iodine by four CupriDyne™ foliar water-spray applications following emergence of alternaria early blight demonstrated equivalent grade and yield of potatoes against conventional organic pesticides. Miller Research, 2009, Rupert, ID



**CupriDyne™ and CupriDyne-SAP™ Coagulation and Flocculation of Hog Manure Wastes, University of Alberta 2009-2010, Edmonton, AB.**

**Table 3.** Characteristics of the liquid swine manure before and after treatment.

Parameter	Supernatant			Diluted Supernatant (1:5)		
	Raw wastewater	After Phase 1	After Phase 2	Raw Wastewater	After Phase 1	After Phase 2
TSS (mg/L)	1,237	840	690	540	110	51
pH	7.7	7.6	7.6	10.9	10.8	10.7
Turbidity (NTU)	459	370	172	211	202	100
Conductivity (mS/cm)	15.7	15.1	12.5	6.3	5.6	3.5
TOC mg/L C	1,858	1,732	580	599	509	118
Total Phosphorous	310	296	286	217	138	69
Total Kjeldahl Nitrogen (mg/L)	2,344	2,012	1,698	727	561	253
Ammonia (mg/L N)	1,662	1,486	304	329	325	163
Alkalinity (mg/L)	7,920	7,000	3,860	9,600	9,000	8,900
COD (mg/L)	10,888	8,459	7,025	2,114	1,755	1,469
BOD <sub>5</sub> (mg/L)	6,345	4,950	2,835	2,430	2,205	1,380
Total Coliform (CFU/100 mL)	1.2 × 10 <sup>6</sup>	1.0 × 10 <sup>5</sup>	8.9 × 10 <sup>4</sup>	9,225	6,150	0
Fecal Coliform	1.1 × 10 <sup>5</sup>	9.3 × 10 <sup>3</sup>	2.1 × 10 <sup>3</sup>	2983	1,669	0
% inhibition of <i>Vibrio fischeri</i>	94.008	92.8	92.1	65.5	64.7	90.9

Note: Phase 1: addition of SAP to the liquid swine manure; Phase 2: addition of free iodine under optimum SAP doses.

**Table 4.** Concentration of main ions before and after treatment.

Ion	Supernatant			Diluted Supernatant (1:5)		
	Raw waste	After Phase 1	After Phase 2	Raw waste	After Phase 1	After Phase 2
<b>Anions</b>						
Chloride (mg/L)	760.8	611.8	486.6	192.1	189.8	100.3
Nitrite (mg/L)	9.1	6.7	4.5	1.5	1.4	0.7
Bromide (mg/L)	6.9	2.2	0.1	1.1	0.9	0.3
Nitrate (mg/L)	7.0	5.2	3.1	0.9	0.4	0.3
Phosphate (mg/L)	111.5	105.4	79.7	17.3	15.2	9.5
Sulphate (mg/L)	7.1	38.3	54.3	27.6	32.3	108.7
Sulphide (mg/L)	21.1	7.3	3.0	0.7	0.6	0.3
<b>Cations</b>						
Sodium (mg/L)	484.6	398.1	322.6	1,241.3	1,226.5	674.0
Potassium (mg/L)	1,003.7	965.7	782.9	204.3	197.5	160.5
Magnesium (mg/L)	12.56	11.57	9.21	35.61	7.49	5.62
Calcium (mg/L)	155.7	122.8	72.0	18.7	16.9	11.0

Note: Phase 1: addition of SAP to the liquid swine manure; Phase 2: addition of free iodine under optimum SAP doses.