

CytoSorbents Corporation (NASDAQ/CTSO)

August 19, 2019

BUY: Does Cytosorb Work?

An article published by a short seller last week sent shares of CTSO lower. We reviewed some of the available data sets from case studies as well as from prior clinical studies. **Our bullish thesis remains intact as we see substantial evidence in real world patients that Cytosorb works.**

Jason H. Kolbert
Head of Healthcare Research
646-465-6891
jkolbert@dawsonjames.com

Current Price \$4.77
Price Target \$15.00

Investment Highlights

We have always been impressed with CEO, Dr. Phillip Chan MD PhD grasp of the medicine and dedication to building this company. We find him to be credible, sincere, passionate and working to help patients by bringing this technology to the marketplace. As such, we went back and reviewed some of the many, many reported case studies. Below is just a small sample of some of the published case studies:

- **A clinical experience of using extracorporeal cytokine adsorption device (CytoSorb) in a case of Dengue fever.** Khan, Z.A. Noble Hospital, Magarpatta Road, Hadapsar, Pune-411028, India. *J Evid Based Med Healthcare.* 2016 3(87): 4779 – 4781.
 - CytoSorb helped to stabilize and revive this patient with dengue, MODS and shock.
 - The majority of laboratory parameters were within the normal range after the therapy and no major adverse events were reported during or after the CytoSorb therapy.
 - This is the first report of the clinical application of CytoSorb hemoadsorption in a case of dengue fever with MODS treated successfully with standard of care along with CytoSorb.
 - CytoSorb seems to be an interesting and safe option to stabilize and help dengue patients with MODS to recover.

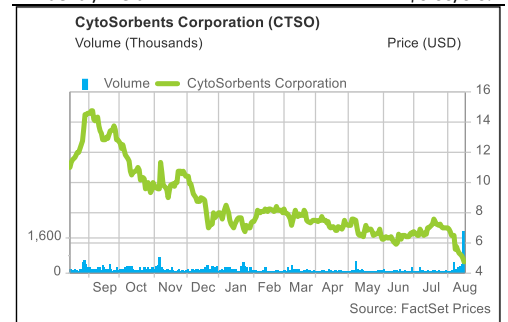
- **Effect of extracorporeal cytokine removal on vascular barrier function in a septic shock patient.** David S1, Thamm K1, Schmidt BM1, Falk CS2, Kielstein JT1. *1 Department of Medicine, Division of Nephrology & Hypertension, Hannover Medical School, Hannover, Germany. 2 Institute of Transplant Immunology, IFB-Tx, Hannover Medical School, Hannover, Germany. J Intensive Care.* 2017 Jan 21;5:12.
 - Extracorporeal cytokine removal using CytoSorb led to a stabilization of septic shock within hours.
 - Due to the observed removal of antibiotics, the authors recommend thorough therapeutic drug monitoring in septic patients, as with the use of any other extracorporeal removal strategies.
 - This is the first publication showing that a protective effect of CytoSorb on capillary integrity, and as a result, on microcirculation, can be assumed with a high probability.

Estimates	F2019E	F2020E	F2021E
Expenses (\$000s)	\$ 41,189	\$ 45,277	\$ 58,224
1Q March	\$ 9,475	\$ 10,414	\$ 13,392
2Q June	\$ 9,862	\$ 10,867	\$ 13,974
3Q September	\$ 10,724	\$ 11,772	\$ 15,138
4Q December	\$ 11,129	\$ 12,225	\$ 15,720

	F2019E	F2020E	F2021E
EPS (diluted)	\$ (0.55)	\$ (0.31)	\$ 0.46
1Q March	\$ (0.15)	\$ (0.07)	\$ 0.11
2Q June	\$ (0.11)	\$ (0.08)	\$ 0.11
3Q September	\$ (0.14)	\$ (0.08)	\$ 0.12
4Q December	\$ (0.14)	\$ (0.08)	\$ 0.12

EBITDA/Share	(\$0.53)	(\$0.34)	\$0.51
EV/EBITDA (x)	0.0	0.0	0.0

Stock Data			
52-Week Range	\$3.68	-	\$14.95
Shares Outstanding (mil.)	32.3		
Market Capitalization (mil.)	\$154		
Enterprise Value (mil.)	\$134		
Debt to Capital	0%		
Book Value/Share	\$0.35		
Price/Book	15.2		
Average Three Months Trading Volume (K)	131		
Insider Ownership	5.1%		
Institutional Ownership	26.9%		
Short interest (mil.)	8.0%		
Dividend / Yield	\$0.00/0.0%		



Update -August 19, 2019 - Buy - Price Target \$15.00

- **Combination of ECMO and cytokine adsorption therapy for severe sepsis with cardiogenic shock and ARDS due to Panton-Valentine leukocidin-positive Staphylococcus aureus pneumonia and H1N1.** *Lees NJ, Rosenberg A, Hurtado-Doce AI, Jones J, Marczin N, Zeriouh M, Weymann A, Sabashnikov A, Simon AR, Popov AF Department of Anaesthetic and Critical Care, Harefield Hospital, Royal Brompton & Harefield NHS Foundation Trust, England J Artif Organs 2016; 19(4): 399 – 402.*
 - This case is the first report of the successful use of extracorporeal support and CytoSorb hemoadsorption therapy in combination to treat a patient with severe acute respiratory failure, septic and cardiogenic shock due to PVL-S. aureus superinfection with H1N1. The authors state, that the reversal of septic shock, the rapid weaning off of the highdose vasopressor infusions as well as the quick resolution of neutropenia and reduction in CRP levels are unusual for such severe presentation, and that they feel that CytoSorb was a beneficial factor in the combination therapy with ECMO.
 - This case report also demonstrates that multiple extracorporeal technologies, including VA ECMO, hemofiltration, and hemoadsorption with CytoSorb can be successfully combined in severe septic shock with myocardial involvement.

- **Cytokine Reduction in the Setting of an ARDS-Associated Inflammatory Response with Multiple Organ Failure.** *Traeger K, Schuetz C, Fischer G, Schroeder J, Skrabal C, Liebold A, Reinelt H, Department of Cardiac Anesthesiology, University Hospital Ulm, Germany. Case Reports in Critical Care, Volume 2016 (2016).*
 - Stabilization and successful treatment of a complicated pulmonary aspiration postsurgical patient with septic shock and polymicrobial infection, severe exudative ARDS, renal failure, and a severe SIRS response with pronounced hypercytokinemia.
 - CytoSorb was easy to use and safe, and no device-related adverse events were observed.
 - Control over the patient's initial hyper-inflammatory response was a key element in helping to clinically stabilize the patient, allowing for organ recovery, and ultimately survival.

- **Observations in early vs. late use of CytoSorb haemadsorption therapy in critically ill patients.** *Kogelmann K, Druener M, Jarczack D. Department of Anesthesiology, Hospital Emden, Germany. Critical Care 2016, 20(Suppl 2):P195.*
 - The authors observed a pronounced reduction in catecholamine dosages and blood lactate values during CytoSorb therapy in these critically ill patients.
 - The patients in whom therapy was started early (<24 hours after diagnosis) showed a significantly higher survival rate than patients with a delay in the start of therapy.
 - These observations show that a preferably early start of CytoSorb therapy not later than 24 hours after diagnosis of severe sepsis / septic shock, could have a favorable effect on the probability of survival.

- **First case of toxic shock treated with haemadsorption by CytoSorb in the Netherlands.** *van der Linde GW, Grootendorst A Department of Intensive Care Medicine, Maasstad Hospital, Rotterdam, The Netherlands. Neth J Crit Care. 24(2): 27-29.*
 - This is the first publication on the use of CytoSorb in a patient with fulminant Toxic Shock Syndrome. The hemodynamic stabilization and reduction of erythema after starting CytoSorb were impressive. The vasopressor dosages could be reduced massively as early as six hours after initiation of treatment.
 - The authors assume that the patient's stay on ICU was shortened considerably by the treatment.
 - Although the clinical value still has to be established, the first experiences with the CytoSorb adsorber are promising and justify further investigation.

Conclusion. We believe there is ample data that suggests Cytosorb, in-fact, works. The above case studies are just a small sample of many more studies available for review. Please see the company's website for the complete listing of studies.

Valuation. We use a series of therapeutic models across the various indications and geographies and project product revenues for the company out to the year 2030. In our U.S. therapeutic models, we apply a 30% risk cut (70% success probability) that both U.S. approvals and our market share forecasts can be realized. For us, valuation becomes an interesting question when we discuss the appropriate "r" risk-rate to use in our three model metrics, free cash flow to the firm (FCFF), Discounted EPS and Sum-Of-The-Parts (SOP) models, which are equal weighted, averaged and rounded to the nearest whole number. Typically for early-stage companies with no revenues, we use 30%, and for companies with established products and revenues, we use a lower 15%. Cytosorbents arguably is somewhere in the middle, as products are approved and selling in Europe but not yet in the U.S. If we select a conservative 30%, we drive a \$9.00 price target. If we select a more aggressive 15%, we arrive at a \$28.00 target. If we select a mid-point (22.5%), we derive a \$15.00 target. Given their unique position of approval in Europe, established proof of concept and a product that works, we select the mid-point of 22.5% and set our target for CytoSorbents at \$15.00.

Exhibit 6. FCFF Model

Average \$	15
Price Target \$	15
Year	2019

DCF Valuation Using FCF (min):

units ('000)	2018A	2019E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
EBIT	(17,830)	(17,160)	(11,025)	16,493	43,837	86,422	151,532	255,996	319,474	360,704	391,365	410,708	407,264
Tax Rate	0%	5%	8%	10%	12%	15%	18%	21%	24%	28%	33%	33%	33%
EBIT (1-t)	(17,830)	(16,302)	(10,143)	14,844	38,577	73,459	124,256	202,237	242,801	259,707	262,215	275,174	272,867
CapEx	(493)	(543)	(597)	(657)	(722)	(794)	(874)	(961)	(1,057)	(1,163)	(1,279)	(1,407)	(1,548)
Depreciation	391	138	-	-	-	-	-	-	-	-	-	-	-
Change in NWC													
FCF	(17,932)	(16,706)	(10,740)	14,187	37,855	72,664	123,382	201,276	241,743	258,544	260,935	273,767	271,319
PV of FCF	(21,967)	(16,706)	(8,767)	9,454	20,593	32,268	44,727	59,563	58,399	50,985	42,006	35,977	29,106
Discount Rate	22.5%												
Long Term Growth Rate	1%												
Terminal Cash Flow	1,274,569												
Terminal Value YE2030	136,731												
NPV	494,335												
NPV-Debt													
Shares out ('000)	33,734												
NPV Per Share	15												

Source: Dawson James estimates

Exhibit 7. Discounted EPS Model

Current Year	2019
Year of EPS	2030
Earnings Multiple	15
Discount Factor	22.5%
Selected Year EPS	8.09
NPV	13.02

Source: Dawson James estimates

		Discount Rate and Earnings Multiple Varies, Year is Constant						
		13.02	5%	10%	15%	20%	25%	30%
Earnings Multiple	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	5	23.65	14.18	8.69	5.44	3.47	2.26	
	10	47.29	28.35	17.39	10.89	6.95	4.51	
	15	70.94	42.53	26.08	16.33	10.42	6.77	
	20	94.59	56.70	34.77	21.77	13.90	9.03	
	25	118.23	70.88	43.47	27.22	17.37	11.28	
	30	141.88	85.05	52.16	32.66	20.84	13.54	
	35	165.53	99.23	60.85	38.10	24.32	15.80	

Source: Dawson James estimates

Exhibit 8. Sum of the Parts Model

CytoSorbents	LT Gr	Discount Rate	Yrs to Mkt	% Success	Peak Sales (MMs)	Term Val
CytoSorb - Sepsis Direct Sales(EU)	1%	22.5%	0	70%	\$151	\$701
NPV						\$7
CytoSorb - Sepsis Distributor (EU)	1%	22.5%	0	70%	\$88	\$408
NPV						\$4
CytoSorb (Cardiac surgery US)	1%	22.5%	2	50%	\$68	\$318
NPV						\$1.43
CytoSorb (Cardiac surgery EU)	1%	22.5%	0	70%	\$17	\$79
NPV						\$0.7
CytoSorb (Sepsis US)	1%	22.5%	4	50%	\$271	\$1,262
NPV						\$3.8
Net Margin						45%
MM Shrs OS (2030E)						33
Total						\$16

Source: Dawson James estimates

Risk Analysis

Market Share Risk: CytoSorbents' potential inability to further grow product sales in the EU will hinder its profitability as more capital is invested in clinical trials to bring CytoSorb to the U.S. market. The company's product represents a new treatment for critical care patients that may take longer for adoption than predicted.

Regulatory Risk: There may be certain regulatory risks related to CytoSorb approval in the U.S.

Commercial Risk: There is no guarantee that the company will be able to develop and expand sales operations to offset research and development costs. Delays in U.S. commercialization will be negatively reflected in its valuation.

Financial Risk: The company should be expected to raise capital in the near term. We assume a raise and dilution, but there is no guarantee that market conditions will be favorable.

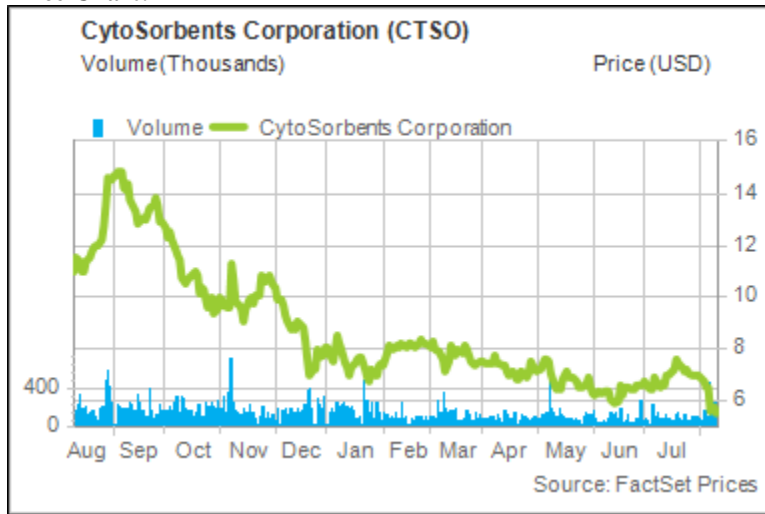
Exhibit 9. Income Statement

CTSQ: Income Statement (\$000)																					
YE December 31	2018A	1Q19A	2Q19A	3Q19E	4Q19E	2019E	1Q20E	2Q20E	3Q20E	4Q20E	2020E	2021E	2022E	2023E	2024E	2025E	2026E	2027E	2028E	2029E	2030E
Revenue:																					
CytoSorb Direct Sales (Germany, Austria, Switzerland)	20,143	4,576	5,850	6,000	6,200	22,148	6,081	6,345	6,874	7,138	26,439	40,239	54,439	69,046	84,070	99,520	115,405	131,735	148,520	150,699	150,699
CytoSorb Distributor (Rest of EU)			-				3,032	3,164	3,428	3,559	13,183	13,336	21,587	27,297	41,422	55,871	70,651	85,766	86,763	87,771	87,771
CytoSorb (Cardiac surgery EU)							1,045	1,091	1,182	1,227	4,545	6,866	9,218	11,604	14,022	16,474	16,589	16,705	16,822	16,940	16,940
CytoSorb (Cardiac surgery US)							-	-	-	-	-	5,345	10,776	16,294	21,899	27,593	66,755	67,290	67,829	68,373	68,373
CytoSorb (sepsis US)												8,773	17,846	45,376	92,302	187,755	200,508	223,353	246,919	271,225	271,225
VetResQ						300	81	84	91	95	350	368	386	405	425	447					
Other Sales	109																				
Total Product Sales	20,252	4,576	5,850	6,000	6,200	22,626	10,239	10,684	11,574	12,020	44,517	74,927	114,251	170,022	254,140	387,660	469,908	524,849	566,853	595,008	595,008
Royalty (HemoDefend US)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grant revenue	2,252	615	382			997															
Other revenue	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Revenue	22,504	5,191	6,232	6,000	6,200	23,623	10,239	10,684	11,574	12,020	44,517	74,927	114,251	170,022	254,140	387,660	469,908	524,849	566,853	595,008	595,008
Expenses:																					
Costs of Goods Sold	7,489	1,738	1,834	1,500	1,550	6,622	2,048	2,137	2,315	2,404	8,903	14,985	22,850	34,004	50,828	77,532	93,982	104,970	113,371	119,002	119,002
%COGS	37%	38%	29%	25%	25%	25%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%	20%
Research and Development	7,723	2,418	2,930	2,733	2,839	10,513	2,660	2,775	3,007	3,122	11,564	12,721	13,993	15,392	16,931	18,624	20,487	22,536	24,789	27,268	29,995
%R&D	38%	53%	50%	46%	46%	46%	26%	26%	26%	26%	26%	17%	12%	9%	7%	5%	4%	4%	4%	5%	5%
Selling, General and Administrative	20,874	4,758	4,506	5,970	6,200	21,434	5,669	5,916	6,409	6,655	24,649	28,346	31,180	31,804	32,440	33,089	33,751	34,426	35,114	35,817	36,533
%SG&A	103%	104%	77%	99%	100%	95%	55%	55%	55%	55%	55%	38%	27%	19%	13%	9%	7%	7%	6%	6%	6%
Legal, financial and other counseling	2,002	561	592	521	541	2,214	509	531	576	598	2,214	2,214	2,214	2,214	2,214	2,214	2,214	2,214	2,214	2,214	2,214
Total Expenses	38,088	9,475	9,862	10,724	11,129	40,783	10,886	11,359	12,306	12,779	47,330	58,266	70,238	83,415	102,413	131,459	150,433	164,145	175,488	184,300	187,743
Operating Income (Loss)	(15,584)	(4,284)	(3,630)	(4,724)	(4,929)	(17,160)	(647)	(675)	(731)	(760)	(2,813)	16,661	44,014	86,607	151,727	256,200	319,474	360,704	391,365	410,708	407,264
Interest income (expense), net	(1,461)	(205)	(214)																		
Gain (loss) on foreign currency transactions	(785)	(393)	297																		
Change in warrant liability																					
Other income (expense), net																					
Total Other Income	(2,246)	(598)	83	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Pretax Income	(17,830)	(4,882)	(3,547)	(4,724)	(4,929)	(17,160)	(647)	(675)	(731)	(760)	(2,813)	16,661	44,014	86,607	151,727	256,200	319,474	360,704	391,365	410,708	407,264
Income Tax Benefit (Provision)	-	-		(236)	(246)	(858)	(52)	(54)	(59)	(61)	(225)	1,666	5,282	12,991	27,311	53,802	76,674	100,997	129,150	135,534	134,397
Tax Rate	0%	0%	5%	5%	5%	5%	8%	8%	8%	8%	8%	10%	12%	15%	18%	21%	24%	28%	33%	33%	33%
GAAP Net Income (Loss)	(17,830)	(4,882)	(3,547)	(4,488)	(4,682)	(16,302)	(595)	(621)	(673)	(699)	(2,588)	14,995	38,732	73,616	124,416	202,398	242,801	259,707	262,215	275,174	272,867
GAAP-EPS	(0.58)	(0.15)	(0.11)	(0.14)	(0.14)	(0.51)	(0.02)	(0.02)	(0.02)	(0.02)	(0.08)	0.46	1.19	2.24	3.78	6.12	7.31	7.79	7.84	8.19	8.09
GAAP-EPS (Dil)	(0.58)	(0.15)	(0.11)	(0.14)	(0.14)	(0.51)	(0.02)	(0.02)	(0.02)	(0.02)	(0.08)	0.46	1.19	2.24	3.78	6.12	7.31	7.79	7.84	8.19	8.09
Wgtd Avg Shrs (Bas) - '000s	30,719	31,931	32,267	32,299	32,331	32,207	32,364	32,396	32,429	32,461	32,412	32,542	32,673	32,803	32,935	33,067	33,199	33,332	33,466	33,600	33,734
Wgtd Avg Shrs (Dil) - '000s	30,719	31,931	32,267	32,299	32,331	32,207	32,364	32,396	32,429	32,461	32,412	32,542	32,673	32,803	32,935	33,067	33,199	33,332	33,466	33,600	33,734

Source: Dawson James estimates

Important Disclosures:

Price Chart:



Price target and rating changes over the past three years:

- Initiated – Buy – July 11, 2019 – Price Target \$15.00
- Update – Buy – August 12, 2019 – Price Target \$15.00
- Update – Buy – August 15, 2019 – Price Target \$15.00
- Update – Buy – August 19, 2019 – Price Target \$15.00

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- 2) **Neutral:** The analyst believes the price of the stock is fairly valued for the next 12-18 months;
- 3) **Sell:** The analyst believes the price of the stock will decline by at least 20% over the next 12-18 months and should be sold.

The following chart reflects the range of current research report ratings for all companies followed by the analysts of the Firm. The chart also reflects the research report ratings relating to those companies for which the Firm has performed investment banking services.

Ratings Distribution	Company Coverage		Investment Banking	
	# of Companies	% of Total	# of Companies	% of Totals
Market Outperform (Buy)	43	84%	13	30%
Market Perform (Neutral)	8	16%	0	0%
Market Underperform (Sell)	0	0%	0	0%
Total	51	100%	13	25%

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