US009409046B2

(12) **United States Patent**
McCullough et al.

(10) **Patent No.: US 9,409,046 B2**
(45) **Date of Patent: Aug. 9, 2016**

(54) **METHOD FOR STABILIZATION AND/OR FIXATION OF LEACHABLE METALS**

(75) Inventors: **Thomas P. McCullough**, Indianapolis, IN (US); **Gary Joel Meyer**, Indianapolis, IN (US)

(73) Assignee: **REMEDIUM SERVICES GROUP, LLC**, Carmel, IN (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 956 days.

(21) Appl. No.: **12/259,578**

(22) Filed: **Oct. 28, 2008**

(65) **Prior Publication Data**

US 2009/0118564 A1 May 7, 2009

Related U.S. Application Data

(60) Provisional application No. 60/984,392, filed on Nov. 1, 2007, provisional application No. 61/075,099, filed on Jun. 24, 2008, provisional application No. 61/102,969, filed on Oct. 6, 2008.

(51) **Int. Cl.**

A62D 3/33	(2007.01)
A62D 101/43	(2007.01)
B01D 53/64	(2006.01)
A62D 101/24	(2007.01)

(52) **U.S. Cl.**

CPC ***A62D 3/33*** (2013.01); ***B01D 53/64*** (2013.01); *A62D 2101/24* (2013.01); *A62D 2101/43* (2013.01); *B01D 2251/402* (2013.01); *B01D 2251/404* (2013.01); *B01D 2257/60* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,230,103	A *	1/1966	Minnick	106/707
3,962,080	A *	6/1976	Dulin et al.	588/317
4,018,867	A *	4/1977	Lee	588/318
4,671,882	A	6/1987	Douglas et al.	
4,829,107	A *	5/1989	Kindt et al.	524/3
4,889,640	A	12/1989	Stanforth	
4,996,032	A *	2/1991	Stowe et al.	423/243.09
5,037,479	A	8/1991	Stanforth	
5,057,194	A *	10/1991	Stewart et al.	205/364
5,719,099	A	2/1998	Bhat	
5,800,716	A *	9/1998	Clarke et al.	210/711
5,985,778	A	11/1999	Bhat	
6,054,074	A *	4/2000	Wu et al.	264/37.29
6,191,068	B1	2/2001	Bhat	
6,313,368	B1	11/2001	Bhat	
6,388,165	B1 *	5/2002	Bhat	588/313
6,656,247	B1 *	12/2003	Genik-Sas-Berezowsky et al.	75/710
7,419,605	B2 *	9/2008	Zhuang	210/725
2004/0018133	A1 *	1/2004	Radway	423/244.05
2005/0116395	A1 *	6/2005	Tsai	264/655
2008/0223098	A1 *	9/2008	Taulbee	71/61

FOREIGN PATENT DOCUMENTS

AT	A171489	*	10/1992
AT	396 101 B		6/1993
JP	63288932	*	2/1989

OTHER PUBLICATIONS

International Preliminary Report on Patentability issued May 4, 2010 for PCT/US2008/081443.

* cited by examiner

Primary Examiner — Melvin C Mayes
Assistant Examiner — Sheng H Davis
(74) *Attorney, Agent, or Firm* — Barnes & Thornburg LLP

(57) **ABSTRACT**

Methods for treatment a heavy metal-contaminated solid, semi-solid, liquid or gaseous matrix with magnesium oxide, magnesium sulfite, magnesium sulfate, magnesium chloride, magnesium hydroxide, and mixtures of any two or more of these. Methods for treatment of a solid or semi-solid waste containing unacceptable levels of leachable aluminum and reactive metallic aluminum-containing waste with magnesium oxide, magnesium sulfite, magnesium sulfate, magnesium hydroxide, magnesium chloride, and mixtures of any two or more of these.

3 Claims, 2 Drawing Sheets