

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

(10) **Patent No.:** **US 9,409,037 B2**
(45) **Date of Patent:** **Aug. 9, 2016**

(54) **ENHANCED ANTI-MICROBIAL PDT**

USPC 607/88; 606/4.01, 5.01; 604/4.01, 5.01,
604/6.04, 6.08, 6.09
See application file for complete search history.

(75) Inventors: **Volker Albrecht**, Nuthetal (DE);
Gerhard Wieland, Jena (DE);
Burkhard Gitter, Jena (DE); **Wolfgang**
Neuberger, Dubai (AE)

(56) **References Cited**

U.S. PATENT DOCUMENTS

(73) Assignee: **Biolitec Pharma Marketing LTD**,
Labuan (MY)

4,573,962 A * 3/1986 Troutner 604/6.08
5,171,749 A * 12/1992 Levy A61K 49/0036
514/3.7
5,912,257 A * 6/1999 Prasad et al. 514/356
6,277,337 B1 * 8/2001 Goodrich et al. 422/186.3
6,969,367 B2 * 11/2005 Tu et al. 604/6.04
7,470,245 B2 * 12/2008 Tu et al. 604/6.09

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 61 days.

(Continued)

(21) Appl. No.: **13/006,274**

Primary Examiner — William Thomson

(22) Filed: **Jan. 13, 2011**

Assistant Examiner — Nathan J Jenness

(65) **Prior Publication Data**

US 2011/0178580 A1 Jul. 21, 2011

(74) *Attorney, Agent, or Firm* — BJ Associates; Bolesh J.
Skutnik

Related U.S. Application Data

(60) Provisional application No. 61/296,084, filed on Jan.
19, 2010.

(51) **Int. Cl.**
A61N 5/06 (2006.01)
A61M 1/36 (2006.01)
A61L 2/00 (2006.01)

(57) **ABSTRACT**

Methods and devices to eliminate, reduce, destroy and/or
inhibit undesired body fluid species, such as pathogen
microbes and deteriorated or malignant cells in complex envi-
ronments like blood, serum and other body fluids are pro-
vided. In preferred embodiments, an antimicrobial photody-
namic therapy (PDT) treatment is given that effectively
inactivates, reduces and/or destroys both Gram (-) and Gram
(+) bacteria in complex body fluids. Methods to enhance
antimicrobial PDT activity include administering a photosen-
sitizer to bacteria-contaminated fluid, after a dwell time guid-
ing bacteria-contaminated fluid with photosensitizer through
a channel, emitting radiation preferably in an intermittent
manner, and restoring treated body fluids to corresponding
body regions. Electromagnetic radiation is preferably deliv-
ered intermittently with pulse width based on treatment
parameters. Additionally, the method/device diminishes
adverse host's inflammatory responses by neutralizing the
biological activity of pathogenic microorganism fragments
and reducing and/or removing pathogenic microorganism
fragments responsible for it.

(52) **U.S. Cl.**
CPC **A61N 5/062** (2013.01); **A61L 2/0029**
(2013.01); **A61L 2/0052** (2013.01); **A61M**
1/3681 (2013.01); **A61N 5/0624** (2013.01);
A61L 2202/21 (2013.01); **A61M 1/3686**
(2014.02); **A61N 2005/063** (2013.01); **A61N**
2005/0652 (2013.01)

(58) **Field of Classification Search**
CPC A61M 1/16; A61M 1/34; A61M 1/36;
A61M 1/3472; A61M 1/3681; A61L 2/0029;
A61L 2/0052; A61N 5/062

10 Claims, 5 Drawing Sheets

