US009636303B2

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

(10) **Patent No.: US 9,636,303 B2**
(45) **Date of Patent: May 2, 2017**

(54) **TAMPER RESISTANT DOSAGE FORM COMPRISING AN ANIONIC POLYMER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 286 days.

(21) Appl. No.: **13/223,384**

(22) Filed: **Sep. 1, 2011**

(65) **Prior Publication Data**

US 2012/0065220 A1 Mar. 15, 2012

Related U.S. Application Data

(60) Provisional application No. 61/379,507, filed on Sep. 2, 2010.

(30) **Foreign Application Priority Data**

Sep. 2, 2010 (EP) 10009125

(51) **Int. Cl.**

A61K 31/485	(2006.01)
A61K 31/135	(2006.01)
A61P 25/04	(2006.01)
A61K 47/34	(2006.01)
A61K 9/20	(2006.01)
A61K 31/137	(2006.01)

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

CPC ***A61K 9/2031*** (2013.01); ***A61K 9/2095*** (2013.01); ***A61K 31/137*** (2013.01); *A61K 9/2013* (2013.01); *A61K 9/2027* (2013.01); *A61K 9/2054* (2013.01)

(58) **Field of Classification Search**

None

See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,524,855	A	10/1950	Schnider et al.
2,806,033	A	9/1957	Lewenstein et al.
2,987,445	A	6/1961	Levesque
3,332,950	A	7/1967	Blumberg et al.
3,370,035	A	2/1968	Ogura et al.
3,652,589	A	3/1972	Flick et al.
3,806,603	A	4/1974	Gaunt et al.
3,865,108	A	2/1975	Hartop
3,941,865	A	3/1976	Miller et al.
3,966,747	A	6/1976	Monkovic et al.
3,980,766	A	9/1976	Shaw et al.
4,002,173	A	1/1977	Manning et al.
4,014,965	A	3/1977	Stube et al.
4,070,494	A	1/1978	Hoffmeister et al.
4,070,497	A	1/1978	Wismer et al.
4,175,119	A	11/1979	Porter
4,200,704	A	4/1980	Stanley et al.
4,207,893	A	6/1980	Michaels
4,262,017	A	4/1981	Kuipers
4,343,789	A	8/1982	Kawata et al.
4,353,887	A	10/1982	Hess et al.
4,404,183	A	9/1983	Kawata et al.
4,427,681	A	1/1984	Munshi et al.
4,427,778	A	1/1984	Zabriskie
4,457,933	A	7/1984	Gordon et al.
4,462,941	A	7/1984	Lee et al.
4,473,640	A	9/1984	Combie et al.
4,483,847	A	11/1984	Augart
4,485,211	A	11/1984	Okamoto
4,529,583	A	7/1985	Porter
4,599,342	A	7/1986	La Hann
4,603,143	A	7/1986	Schmidt
4,612,008	A	9/1986	Wong et al.
4,629,621	A	12/1986	Snipes

(Continued)

FOREIGN PATENT DOCUMENTS

AR	46994	A1	12/2004
AR	045353	A1	10/2005

(Continued)

OTHER PUBLICATIONS

"Polyox water soluble resins" 2003. http://www.dow.com/webapps/lit/litorder.asp?filepath=polyox/pdfs/noreg/326-00002.pdf.*

Bauer et al. Lehrbuch der Pharmazeutischen Technologie. Eight Edition 2006. Stuttgart, pp. 343-352.

Hartauer, Pharma. Dev. & Tech, 5 (3) 303-310 (2000).

Marques, Tablet breaking force, 2008.

Ritschel et al. Die Tablette: Handbuch der Entwicklung, Herstellung und Qualitatssicherung, 2nd Edition, 2002. Ch 6, pp. 69-82 and 115-136.

Ritschel et al. Die Tablette: Handbuch der Entwicklung, Herstellung und Qualitatssiehcrung 2nd Edition, 2002, Table of content.

Wagner, Pharmazeutische Biologie—Drogen und ihre Inhaltsstoffe—Scharfstoffdrogen. 2nd., revised edition, Gustav Fischer Verlag, Stuttgart-N.Y., 1982, Table of Content.

(Continued)

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(57) **ABSTRACT**

A pharmaceutical dosage form and method of using same, the pharmaceutical dosage form exhibiting a breaking strength of at least 500 N, said dosage form containing

- a pharmacologically active ingredient (A);
- a physiologically acceptable polymer (B) obtainable by polymerization of a monomer composition comprising an ethylenically unsaturated monomer bearing an anionic functional group, in protonated form or a physiologically acceptable salt thereof;
- a polyalkylene oxide (C) having a weight average molecular weight of at least 200,000 g/mol, wherein the content of the polyalkylene oxide (C) is at least 20 wt.-%, based on the total weight of the dosage form;

wherein the pharmacologically active ingredient (A) is present in a controlled-release matrix comprising the polymer (B) and the polyalkylene oxide (C).

10 Claims, 17 Drawing Sheets