



- (51) **International Patent Classification:**
A61K 9/08 (2006.01) *A61K 39/395* (2006.01)
A61K 47/18 (2006.01) *C07K 1/14* (2006.01)
- (21) **International Application Number:** PCT/US2014/055245
- (22) **International Filing Date:** 11 September 2014 (11.09.2014)
- (25) **Filing Language:** English
- (26) **Publication Language:** English
- (30) **Priority Data:**
- | | | |
|------------|--------------------------------|----|
| 61/876,621 | 11 September 2013 (11.09.2013) | US |
| 61/940,227 | 14 February 2014 (14.02.2014) | US |
| 61/943,197 | 21 February 2014 (21.02.2014) | US |
| 61/946,436 | 28 February 2014 (28.02.2014) | US |
| 61/988,005 | 2 May 2014 (02.05.2014) | US |
| 62/008,050 | 5 June 2014 (05.06.2014) | US |
| 62/026,497 | 18 July 2014 (18.07.2014) | US |
| 62/030,521 | 29 July 2014 (29.07.2014) | US |
- (71) **Applicant:** ARSIA THERAPEUTICS, INC. [US/US]; 1000 Winter Street, Suite 3350, Waltham, Massachusetts 02451 (US).
- (72) **Inventors:** WEIGHT, Alisha K.; 15522 25th Drive, SE, Mill Creek, Washington 98012 (US). LARSON, Alyssa M.; 25086 Perch Drive, Dana Point, California 92629 (US). LANGER, Robert S.; 98 Montvale Road, Newton, Massachusetts 02459 (US). KLIBANOV, Alexander M.; 85 East India Row, Apartment 23A, Boston, Massachusetts 02110 (US). LOVE, Kevin; 403 Commonwealth Avenue #5R, Boston, Massachusetts 02215 (US). CRANE, Alan; 25 Quidnic Road, Waban, Massachusetts 02459 (US).
- (74) **Agents:** PABST, Patrea L. et al.; Pabst Patent Group LLP, 1545 Peachtree Street, NE, Suite 320, Atlanta, Georgia 30309 (US).
- (81) **Designated States** (*unless otherwise indicated, for every kind of national protection available*): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.
- (84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).
- Published:**
- with international search report (Art. 21(3))
 - before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))
- (88) **Date of publication of the international search report:** 23 July 2015



(54) **Title:** LIQUID PROTEIN FORMULATIONS CONTAINING IONIC LIQUIDS

(57) **Abstract:** Concentrated, low-viscosity, low-volume liquid pharmaceutical formulations of proteins have been developed. Such formulations can be rapidly and conveniently administered by subcutaneous or intramuscular injection, rather than by lengthy intra-venous infusion. These formulations include low-molecular-weight and/or high-molecular-weight proteins, such as mAbs, and viscosity-reducing ionic liquids.

INTERNATIONAL SEARCH REPORT

International application No PCT/US2014/055245

A. CLASSIFICATION OF SUBJECT MATTER
 INV. A61K9/08 A61K47/18 A61K39/395 C07K1/14
 ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 A61K C07K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
 EPO-Internal, BIOSIS, EMBASE, WPI Data, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CHARUDHARSHINI SRINIVASAN ET AL: "Non-Aqueous Suspensions of Antibodies are Much Less Viscous Than Equally Concentrated Aqueous Solutions", PHARMACEUTICAL RESEARCH, vol. 30, no. 7, 30 March 2013 (2013-03-30), pages 1749-1757, XP055153478, ISSN: 0724-8741, DOI: 10.1007/s11095-013-1017-4 cited in the application abstract page 1749, right-hand column, paragraph 1 page 1750, left-hand column, paragraph 2 - paragraph 3 page 1750, right-hand column, paragraph 1 - page 1751, right-hand column, paragraph 1 page 1751, right-hand column, paragraph 2 - page 1753, right-hand column, paragraph 2 -/--	1-34

Further documents are listed in the continuation of Box C. See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family
--	--

Date of the actual completion of the international search 25 November 2014	Date of mailing of the international search report 29/05/2015
---	--

Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Epskamp, Stefan
--	---

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2014/055245

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	<p>1; figure 1; tables I-VI page 1754, right-hand column, last paragraph - page 1756, right-hand column, paragraph 1; figure 4; tables VII,VIII ----- WO 2011/069037 A2 (UNIV NORTH CAROLINA [US]; CHARLOTTE MECKLENBURG HOSPITAL [US]; UNIV MO) 9 June 2011 (2011-06-09) page 3, paragraph 1 - paragraph 3 page 10, last paragraph - page 11, paragraph 5 page 15, last paragraph - page 16, paragraph 1 examples claims -----</p>	1-34

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2014/055245

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.
2. As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.
3. As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:
4. No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

1-34

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-34

A pharmaceutical formulation for injection comprising:
(i) one or more proteins;
(ii) one or more viscosity-reducing ionic liquids;
(iii) a pharmaceutically acceptable solvent;
wherein when the proteins are combined with solvent and viscosity-reducing ionic liquids in a volume suitable for injection, the formulation has an absolute viscosity from about 1 cP to about 50 cP at 25°C as measured using a cone and plate viscometer; and the absolute viscosity of the formulation is less than the absolute viscosity of the otherwise same formulation comprising an equivalent amount of sodium phosphate in place of the viscosity-reducing ionic liquid, wherein the absolute viscosity in each case is an extrapolated zero-shear viscosity.

2. claims: 35, 36

A method of facilitating purification of a protein comprising adding to a protein solution an effective amount of an ionic liquid of any of claims 1 or 7-10 to reduce the viscosity of the protein solution.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2014/055245

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2011069037 A2	09-06-2011	US 2012230944 A1	13-09-2012
		WO 2011069037 A2	09-06-2011
