

اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة : 1042 تاريخ الاعتماد 8-9-2021

بيان اعضاء هيئة التدريس الحاصلين على براءة الاختراع في العام الدراسي

2021-2020

براءة الاختراع	العام	اسم العضو
1. Methanol Extract of Grape Seed Nanoparticles. 2. Methods of synthesizing Custard Apple Peel Nanoparticiles.	2020	أ.د. محمد فكرى سراج
3. Mangosteen Nanoparticiles	2021	

عميد الكلية  
أ.د. شريف صبري رجب

مدير وحدة الجودة  
أ.د. خالد محي الدين



اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة : 1042 تاريخ الاعتماد 8-9-2021

#### Publications:

##### US Patents:

#### 4. Method of Synthesizing Doum Nanoparticles .

MA Awad, AA Hendi, KM Ortashi, HM Yehia, MM Ahmed, HS Ali, [MF Serag El-Din](#), ZK Hassan,

Patent No: US 10,188,116 B1.

Date of patent : Jan. 29, 2019.

#### 5. Guava Seed (*Psidium Guajava*) Nanoparticles as Antibacterial Agent.

HS Ali, RA Alajmi, HM Yehia, [MF Serag El-Din](#), MF Elkhadragey, MA Awad, DM Hasanin, 2019.

Patent No: US 10,206,417 B1.

Date of patent : Feb. 19, 2019.

#### 6. Synthesis of Black Eggplant (*Solanum Melongena*) Skin Antioxidant Nanoparticles.

HM Yehia , [MF Serag El-Din](#), HS Ali, MS Alamri, WA Al-Megrin, MF Elkhadragey, MA Awad, Patent No: US 10,500,244 B1.

Date of patent : Dec. 10, 2019.

#### 7. Methanol Extract of Grape Seed Nanoparticles.

HM Yehia , RA Alajmi, HS Ali, MF Elkhadragey, DM Hasanin, [MF Serag El-Din](#), MA Awad.

Patent No: US 10,542,758 B1.

Date of patent : Jan. 28, 2020

#### 8. Methods of synthesizing Custard Apple Peel Nanoparticles.

HM Yehia , HS Ali, EM Al Olayan, MF Elkhadragey, [MF Serag El-Din](#), MA Awad.

Patent No: US 20/20/0316148 A1.

Date of patent : Oct. 8, 2020.

#### 6. Mangosteen Nanoparticles.

HM Yehia, MA Awad, [MF Serag El-Din](#), HS Ali, RA Alajmi, DM Hasanin, WA Al-Megrin, MF Elkhadragey.

Patent No: US 10,898,533 B1.

Date of patent : Jan. 26, 2021.

عميد الكلية  
أ.د. شريف صبري رجب

مدير وحدة الجودة  
أ.د. خالد محي الدين



اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة: 1042 تاريخ الاعتماد: 8-9-2021



US010188116B1

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

(10) **Patent No.:** US 10,188,116 B1  
(45) **Date of Patent:** Jan. 29, 2019

(54) **METHOD OF SYNTHESIZING DOUM NANOPARTICLES**

FOREIGN PATENT DOCUMENTS

(71) Applicant: **KING SAUD UNIVERSITY**, Riyadh (SA)

KR 1020040110242 A 5/2004  
KR 1020150082734 A 7/2015  
WO 2016076691 A2 5/2016

(72) Inventors: **Manal Ahmed Gasmelseed Awad**, Riyadh (SA); **Awatif Ahmed Hendi**, Riyadh (SA); **Khalid Mustafa Osman Ortashi**, Riyadh (SA); **Hany Mohamed Yehia**, Cairo (EG); **Mohamed Mahmoud Hafez Ahmed**, Cairo (EG); **Hatem Salama Mohamed Ali**, Cairo (EG); **Mohamed Fekry Serag El-Din**, Minuyfiya (EG); **Zeinab Korany Mohamed Hassan**, Cairo (EG)

OTHER PUBLICATIONS

(73) Assignee: **King Saud University**, Riyadh (SA)

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **15/855,332**

(22) Filed: **Dec. 27, 2017**

(51) **Int. CL**  
*A61K 36/889* (2006.01)  
*A01N 65/40* (2009.01)  
*A01N 25/12* (2006.01)

(52) **U.S. CL**  
CPC ..... *A01N 65/40* (2013.01); *A01N 25/12* (2013.01)

(58) **Field of Classification Search**  
None  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,623,067 B1 4/2017 Awad et al.

Angellier et al. (2004) 5, 1545-1551. (Year: 2004).  
Seleem et al. (2015) Food and Nutrition Sciences, vol. 06, Issue 07, pp. 622-632. (Year: 2015).  
Aboshora et al. (2016) J. Food Sci. Technol. 53(1): 591-600. (Year: 2016).  
Aboshora et al. (2014) Tropical Journal of Pharmaceutical Research, Dec. 2014, 13(12): 2057-2063. (Year: 2014).  
Le Corre et al. (2010) Biomacromolecules, 11, 1139-1153. (Year: 2010).  
Aboshora, "Effect of Extraction Method and Solvent Power on Polyphenol and Flavonoid Levels in *Hyphaene thebaica* L. Mart (Arecaceae) (Doum) Fruit, and its Antioxidant and Antibacterial Activities," Tropical Journal of Pharmaceutical Research, Dec. 2014.  
Aamer, "Characteristics of aqueous doum fruit extract and its utilization in some novel products," Annals of Agricultural Sciences, vol. 61, Issue 1 Jun. 2016, pp. 25-33.

\* cited by examiner

*Primary Examiner* — Christopher R Tate  
*Assistant Examiner* — Russell G Fiebig  
(74) *Attorney, Agent, or Firm* — Richard C. Litman

(57) **ABSTRACT**

Doum nanoparticles can be synthesized by drying Doum fruit, reducing the dried Doum fruit to a powder or flour, and subjecting the powder to acid hydrolysis or alcohol hydrolysis to provide Doum nanoparticles. The Doum nanoparticles can be used as a food preservative. When compared to bulk Doum particles, the Doum nanoparticles can provide substantially increased antibacterial activity.

**1 Claim, 2 Drawing Sheets**



تاريخ الاعتماد 8-9-2021

رقم الوثيقة : 1042

اسم المعيار: البحث العلمي والأنشطة العلمية

عميد الكلية  
أ.د. شريف صبري رجب

مدير وحدة الجودة  
أ.د. خالد محي الدين

اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة: 1042 تاريخ الاعتماد: 8-9-2021



US010206417B1

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

(10) Patent No.: **US 10,206,417 B1**  
(45) Date of Patent: **Feb. 19, 2019**

(54) **GUAVA SEED (*PSIDIUM GUAJAVA*) NANOPARTICLES AS ANTIBACTERIAL AGENT**

(71) Applicant: **KING SAUD UNIVERSITY, Riyadh (SA)**

(72) Inventors: **Hatem Salama Mohamed Ali, Cairo (EG); Reem Atta Alajmi, Riyadh (SA); Hany Mohamed Yehia, Riyadh (SA); Mohamed Fekry Serag El-Din, Shebin El-Kom (EG); Manal Fawzy Elkhadragy, Cairo (EG); Manal Ahmed Gasmelseed Awad, Riyadh (SA); Dina Mahmoud Metwally Hasanin, Zagzig (EG)**

(73) Assignee: **King Saud University, Riyadh (SA)**

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/003,042**

(22) Filed: **Jun. 7, 2018**

(51) **Int. Cl.**  
*B65D 81/28* (2006.01)  
*A23L 3/3472* (2006.01)

(52) **U.S. Cl.**  
CPC ..... *A23L 3/3472* (2013.01); *A23V 2002/00* (2013.01); *B65D 81/28* (2013.01)

(58) **Field of Classification Search**  
None  
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

9,526,754 B1	12/2016	Serrano	
2008/0274195 A1*	11/2008	Nicolosi	A61K 9/1075
			424/489
2011/0190197 A1*	8/2011	Franco	C07K 14/415
			514/2.3

FOREIGN PATENT DOCUMENTS

CN	104045420 A	9/2014
CN	106109584 A	11/2016
CN	106465736 A	3/2017
JP	2006055038 A	3/2006
KR	20150107504 A	9/2015

OTHER PUBLICATIONS

Hi Castro-Vargas, Li Rodriguez-Varela, SRS Ferreira, F Parada-Alfonso. "Extraction of phenolic fraction from guava seeds (*Psidium guajava* L.) using supercritical carbon dioxide and co-solvents." *Journal of Supercritical Fluids*, vol. 51, 2010, pp. 319-324. (Year: 2010).\*

JY Salib, HN Michael. "Cytotoxic phenylethanol glycosides from *Psidium guajava* seeds." *Phytochemistry*, vol. 65, 2004, pp. 2091-2093. (Year: 2004).\*

YP Chang, MP Tan, WL Lok, S Pakianathan, Y Supramaniam. "Making Use of Guava Seed (*Psidium guajava* L.): The Effects of Pre-treatments on Its Chemical Composition." *Plant Foods Human Nutrition*, vol. 69, 2014, pp. 43-49. (Year: 2014).\*

AMA Uchoa-Thomaz et al. "Chemical composition, fatty acid profile and bioactive compounds of guava seeds (*Psidium guajava* L.)." *Food Science and Technology Campinas*, vol. 34(3), Jul.-Sep. 2014, pp. 485-492. (Year: 2014).\*

A Arain, STH Sherazi, Sam Sirajuddin. "Spectroscopic and chromatographic evaluation of solvent extracted guava seed oil." *International Journal of Food Properties*, vol. 20, No. S1, pp. S556-S563 and a title page, available online Jun. 13, 2017 (Year: 2017).\*

F Wang, Y-H Chen, Y-J Zhang, G-F Deng, Z-F Zou, A-N Li, D-P Xu, H-B Li. "Chemical Components and Bioactivities of *Psidium guajava*." *International Journal of Food Nutrition and Safety*, vol. 5(2), 2014, pp. 98-114. (Year: 2014).\*

KPV Kumar, MSN Pillai, GR Thusnavis. "Seed Extract of *Psidium guajava* as Ecofriendly Corrosion Inhibitor for Carbon Steel in Hydrochloric Acid Medium." *Journal of Materials Science and Technology*, vol. 27(12), 2011, pp. 1143-1149. (Year: 2011).\*

PB Pellegrini et al. "Identification of a novel storage glycine-rich peptide from guava (*Psidium guajava*) seeds with activity against Gram-negative bacteria." *Peptides*, vol. 29, 2008, pp. 1271-1279. (Year: 2008).\*

A Bernardino-Nicanor, AA Scilingo, MC Anon, G Davila-Ortiz. "Guava seed storage protein: Fractionation and characterization." *LWT*, vol. 39, 2006, pp. 902-910. (Year: 2006).\*

T Hintz, KK Matthews, R Di. "The Use of Plant Antimicrobial Compounds for Food Preservation." *Handawi Publishing Corporation, BioMed Research International* vol. 2015, Article ID 246264, pp. 1-12, published 2015. (Year: 2015).\*

K Ravi, P Divyashree. "Psidium guajava: A review on its potential as an adjunct in treating periodontal disease." *Pharmacognosy Review*, vol. 8(16), Jul.-Dec. 2014, Pubmed Central Copy—PMID 25125881 and PMCID: PMC4127827, 10 printed pages. (Year: 2014).\*

Braga et al., "Antioxidant, Antibacterial and Antitumor Activity of Ethanolic Extract of the *Psidium guajava* Leaves", *American Journal of Plant Sciences*, Nov. 2014, 5, 3492-3500.

Valencia-Leal, S.A. et al., "Evaluation of Guava Seeds (*Psidium guajava*) as a Low Cost Biosorbent for the Removal of Fluoride from Aqueous Solutions", *International Journal of Engineering Research and Development*, Dec. 2012, vol. 5, Issue 4, pp. 69-76.

Madhumitha, G., et al., "Devastated Crops: Multifunctional Efficacy for the Production of Nanoparticles", *Journal of Nanomaterials*, 2013, Article ID 951858, pp. 1-12.

\* cited by examiner

Primary Examiner — Isaac Shomer  
(74) Attorney, Agent, or Firm — Richard C. Litman

(57) **ABSTRACT**

The guava seed (*Psidium guajava*) nanoparticles as an antibacterial agent are prepared from guava seeds that have been washed, dried, and ground to powder of less than 1 mm diameter. The powder is reduced to nanoparticle size (less than 100 nm diameter) by adding the powder to a solution of concentrated hydrochloric acid (38% w/w) and stirring the mixture at 3000 rpm at room temperature. The resulting nanoparticles are filtered through a Millipore membrane filter and dried. Agar well diffusion studies showed significant antibacterial activity against various Gram positive and negative species commonly implicated in food contamination. Further testing showed the guava seed nanoparticles have significant antioxidant and radical scavenging content, suggesting that guava seed nanoparticles may serve as an antibacterial agent.

5 Claims, 1 Drawing Sheet

عميد الكلية  
أ.د. شريف صبري رجب

مدير وحدة الجودة  
أ.د. خالد محي الدين



اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة : 1042 تاريخ الاعتماد 8-9-2021

اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة: 1042 تاريخ الاعتماد: 8-9-2021



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

(10) **Patent No.:** US 10,500,244 B1  
(45) **Date of Patent:** Dec. 10, 2019

(54) **SYNTHESIS OF BLACK EGGPLANT (*SOLANUM MELONGENA*) SKIN ANTIOXIDANT NANOPARTICLES**

(71) Applicant: **KING SAUD UNIVERSITY**, Riyadh (SA)

(72) Inventors: **Hany Mohamed Yehia**, Helwan (EG); **Mohamed Fekry Serag El-Din**, Riyadh (SA); **Hatem Salama Mohamed Ali**, Cairo (EG); **Mohamed Saleh Alamri**, Riyadh (SA); **Wafa Abdullah Al-Megrin**, Riyadh (SA); **Manal Fawzy Elkhadragey**, Hewan (EG); **Manal Ahmed Gasmelseed Awad**, Riyadh (SA)

(73) Assignee: **King Saud University**, Riyadh (SA)

(\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **16/408,992**

(22) Filed: **May 10, 2019**

(51) **Int. Cl.**  
**A61K 36/81** (2006.01)  
**A61K 9/16** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **A61K 36/81** (2013.01); **A61K 9/16** (2013.01); **A61K 9/1682** (2013.01); **A61K 2236/33** (2013.01); **A61K 2236/39** (2013.01); **A61K 2236/51** (2013.01)

(58) **Field of Classification Search**  
CPC ..... **A61K 36/81**  
See application file for complete search history.

(56) **References Cited**  
U.S. PATENT DOCUMENTS

2004/0249138 A1 12/2004 Lawson

FOREIGN PATENT DOCUMENTS

CN 103146389 A 6/2013  
CN 107941764 A 4/2018  
KR 101434219 B1 8/2014  
KR 20180053946 A 5/2018

OTHER PUBLICATIONS

Azevedo et al., "Differential response related to genotoxicity between eggplant (*Solanum melongena*) skin aqueous extract and its main purified anthocyanin (delphinidin) in vivo," Food and Chemical Toxicology 45(5):852-858, 2007.\*

Azevedo, L., et al., "Differential response related to genotoxicity between eggplant (*Solanum melongena*) skin aqueous extract and its main purified anthocyanin (delphinidin) in vivo," Food and Chemical Toxicology, 45(5): 852-858, 2007.

Cao, G., et al., "Antioxidant Capacity of Tea and Common Vegetables," J. of Ag. and Food Chem. 44(11): 3426-3431, 1996.

(Continued)

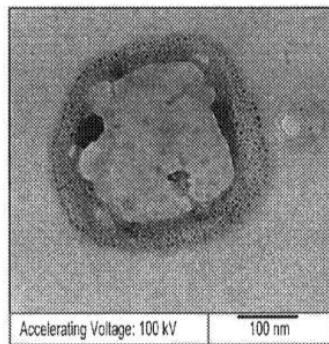
Primary Examiner — Rosanne Kosson

(74) Attorney, Agent, or Firm — Richard C. Litman; Nath, Goldberg & Meyer

(57) **ABSTRACT**

The black eggplant skin antioxidant nanoparticles may be manufactured by extracting black eggplant skins in a solvent, spraying the black eggplant skin extracts into boiling water under ultrasonic conditions to produce a first mixture, sonicating the mixture, stirring the mixture, and drying the mixture to obtain black eggplant skin antioxidant nanoparticles. In an embodiment, the black eggplant skin may be skin of *Solanum melongena*. In an embodiment, the black eggplant skin nanoparticles may have improved antibacterial or antioxidant properties.

**10 Claims, 3 Drawing Sheets**



عميد الكلية  
أ.د. شريف صبري رجب

مدير وحدة الجودة  
أ.د. خالد محي الدين

اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة: 1042 تاريخ الاعتماد: 2021-9-8



US 20200316148A1

(19) **United States**  
 (12) **Patent Application Publication** (10) **Pub. No.: US 2020/0316148 A1**  
 YEHIA et al. (43) **Pub. Date: Oct. 8, 2020**

(54) **METHOD OF SYNTHESIZING CUSTARD APPLE PEEL NANOPARTICLES**

(71) Applicant: **KING SAUD UNIVERSITY, RIYADH (SA)**

(72) Inventors: **HANY M. YEHIA, CAIRO (EG); HATEM SALAMA ALI, CAIRO (EG); EBTESAM MOHAMMED AL OLAYAN, RIYADH (SA); MANAL FAWZY ELKHADRAGY, RIYADH (SA); MOHAMED FEKRY MANSOUR SERAG EL DIN, RIYADH (SA); MANAL AHMED AWAD, RIYADH (SA)**

(73) Assignee: **KING SAUD UNIVERSITY**

(21) Appl. No.: **16/376,231**

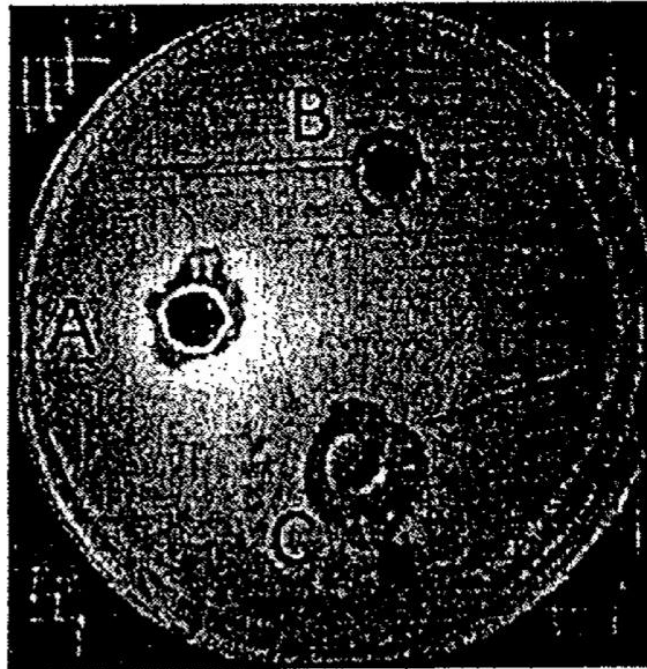
(22) Filed: **Apr. 5, 2019**

**Publication Classification**

(51) **Int. Cl.**  
**A61K 36/185** (2006.01)  
**A61K 9/51** (2006.01)  
 (52) **U.S. Cl.**  
 CPC ..... **A61K 36/185** (2013.01); **A61K 9/51** (2013.01); **B82Y 5/00** (2013.01); **A61K 2236/51** (2013.01); **A61K 2236/33** (2013.01)

(57) **ABSTRACT**

The custard apple peel nanoparticles may be manufactured by extracting custard apple peels in a solvent, spraying the custard apple peel extracts into boiling water under ultrasonic conditions to produce a first mixture, sonicating the mixture, stirring the mixture, and drying the mixture to obtain custard apple peel nanoparticles. In an embodiment, the custard apple peel may be peel of *Amnona reticulata*. In an embodiment, the custard apple peel nanoparticles may have improved antibacterial or antioxidant properties.



*Yersinia enterocolitica*





اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة : 1042 تاريخ الاعتماد 8-9-2021

عميد الكلية  
أ.د. شريف صبري رجب

مدير وحدة الجودة  
أ.د. خالد محي الدين

اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة: 1042 تاريخ الاعتماد: 8-9-2021



US010898533B1

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

(10) Patent No.: **US 10,898,533 B1**  
(45) Date of Patent: **Jan. 26, 2021**

(54) **MANGOSTEEN NANOPARTICLES**

(56) **References Cited**

(71) Applicant: **KING SAUD UNIVERSITY**, Riyadh (SA)

U.S. PATENT DOCUMENTS

(72) Inventors: **Hany Mohamed Yehia**, Riyadh (SA); **Manal Ahmed Gasmelseed Awad**, Riyadh (SA); **Mohamed Fekry Serag El-Din**, Shebin El-Kom (EG); **Hatem Salama Mohamed Ali**, Cairo (EG); **Reem Atta Alajmi**, Cairo (EG); **Dina Mahmoud Metwally Hasanin**, Zagazig (EG); **Wafa Abdullah Al-Megrin**, Riyadh (SA); **Manal Fawzy Elkhadragey**, Riyadh (SA)

9,480,656 B1 *	11/2016	Awad .....	A61K 9/5089
9,700,512 B1 *	7/2017	Wagealla .....	A61K 31/353
9,789,146 B1 *	10/2017	Awad .....	A61K 9/5161
10,022,412 B2	7/2018	Lee et al.	
10,086,027 B1 *	10/2018	Elgamal .....	A61K 9/7007
10,363,218 B1 *	7/2019	Virk .....	A61K 35/741
10,442,833 B1 *	10/2019	El Dib .....	A01N 37/36
10,588,929 B1 *	3/2020	Ortashi .....	A61K 38/00
2003/0091417 A1	5/2003	Rojanapanthu et al.	
2020/0165292 A1 *	5/2020	El Dib .....	A01N 25/34
2020/0165293 A1 *	5/2020	El Dib .....	A01N 25/34
2020/0165294 A1 *	5/2020	El Dib .....	A01N 25/34

(73) Assignee: **KING SAUD UNIVERSITY**, Riyadh (SA)

FOREIGN PATENT DOCUMENTS

(\* ) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

CN	1436786 A	8/2003
CN	105815497 A	8/2016
JP	09110688 A	4/1997
KR	101989971 b1	6/2019

OTHER PUBLICATIONS

(21) Appl. No.: **16/752,669**

(22) Filed: **Jan. 26, 2020**

(51) **Int. Cl.**  
**A61K 36/38** (2006.01)  
**A61K 9/51** (2006.01)  
**A61P 31/04** (2006.01)

(52) **U.S. Cl.**  
CPC ..... **A61K 36/38** (2013.01); **A61K 9/5192** (2013.01); **A61P 31/04** (2018.01); **A61K 2236/17** (2013.01)

(58) **Field of Classification Search**  
CPC ..... A01N 37/36; A01N 25/34; A01N 65/00; A01N 59/16; A01N 65/08; A61K 9/14; A61K 2236/39; A61K 36/185; A61K 9/16; A61K 2236/51; A61K 9/5192; A61K 2236/00; A61K 31/336; A61K 33/00; A61K 9/1682; A61K 9/5115; A61K 9/5138; A61K 2236/15; A61K 2236/31; A61K 2236/33; A61K 2236/331; A61K 2236/333; A61K 2236/53; A61K 31/353; A61K 33/24; A61K 33/30; A61K 35/00; A61K 35/741; A61K 36/31; A61K 36/42; A61K 36/53; A61K 36/81; A61K 38/00; A61K 9/19; A61K 9/5026; A61K 9/5036; A61K 9/5073; A61K 9/5089; A61K 9/5146; A61K 9/5161; A61K 9/7007; A61K 36/38; A61K 2236/17; B82Y 40/00; B82Y 5/00; B82Y 30/00; C07J 63/008; C07J 53/002; A61P 31/04; A61P 35/00; A61P 1/16; A61P 31/10; A61P 39/06; A23K 10/18; A23L 33/00; A23L 33/135; B22F 1/0044; B22F 2009/245; B22F 2301/255; B22F 2998/10; B22F 9/24; B29C 67/00; C01B 2202/04; C01B 2202/06; C01B 32/152; C01B 32/16; C01B 32/174; C01G 9/02; C01P 2004/16; C01P 2004/32; C01P 2004/62; C01P 2004/64; C07C 7/005; C12P 3/00; D21H 13/50

See application file for complete search history.

Lim, Y. S. et al., "Antioxidant capacity and antibacterial activity of different parts of mangosteen (*Garcinia mangostana* Linn.) extracts," *Fruits*, 2013, vol. 68(6), pp. 483-489.  
"Natural Home Cures Freeze Dried Rich Pericarp Mangosteen," Copyright © 2019 Welcome to Natural Home Cures Freeze Dried Rich Pericarp Mangosteen, website: <http://www.mymangosteen.com>. net last accessed: Jan. 8, 2020.  
Pothitirat, W., et al., "Comparison of bioactive compounds content, free radical scavenging and anti-acne inducing bacteria activities of extracts from the mangosteen fruit rind at two stages of maturity," *Fioterapia*, vol. 80, pp. 442-447, 2009.  
Suksamran, S. et al., "Xanthenes from the green fruit hulls of *Garcinia mangostana*," *J Nat Prod.*, vol. 65, 99, 761-763, 2002.  
Jung, H. A. et al., "Antioxidant xanthenes from the pericarp of *Garcinia mangostana* (Mangosteen)," *J. Agri. Food Chem.*, vol. 54, pp. 2077-2082, 2006.

(Continued)

*Primary Examiner* — Aaron J Kosar  
(74) *Attorney, Agent, or Firm* — Nath, Goldberg & Meyer; Richard C. Litman

(57) **ABSTRACT**

Mangosteen nanoparticles and methods of synthesizing Mangosteen nanoparticles are provided. The Mangosteen nanoparticles may be synthesized by drying Mangosteen, *Garcinia mangostana* fruit, grinding the dried Mangosteen to form powdered Mangosteen, suspending the powdered Mangosteen in a solvent to form a first Mangosteen solution, spraying the Mangosteen solution into boiling water under ultrasonic conditions to form a second Mangosteen solution, resting the second Mangosteen solution at room temperature (about 20° C.), and freeze-drying the second Mangosteen solution to obtain Mangosteen nanoparticles. The drying step may include either air-drying or freeze-drying the Mangosteen. The Mangosteen fruit peel may be used in the drying step instead of the inner Mangosteen fruit. The resulting nanoparticles may be used in pharmaceutical compositions, and may be useful for their antioxidant and antibacterial activities.

**19 Claims, 4 Drawing Sheets**



اسم المعيار: البحث العلمي والأنشطة العلمية رقم الوثيقة : 1042 تاريخ الاعتماد 8-9-2021