

Green Synthesis of Mesquite-Gum-Stabilized Gold Nanoparticles for Biomedical Applications: Physicochemical Properties and Biocompatibility Assessment

Ana M. Pinilla-Torres ^{1,†}, Celia N. Sanchez-Dominguez ^{2,†}, Karla Basilio-Bernabe ¹, Paola Y. Carrion-Garcia ², Jorge A. Roacho-Perez ², Elsa N. Garza-Treviño ², Hugo Gallardo-Blanco ^{3,*} and Margarita Sanchez-Dominguez ^{1,*}

¹ Grupo de Química Coloidal e Interfacial Aplicada a Nanomateriales y Formulaciones, Centro de Investigación en Materiales Avanzados, S.C. (CIMAV, S.C.), Unidad Monterrey, Apodaca 66628, Mexico; ana.pinilla@cimav.edu.mx (A.M.P.-T.); karlabasiliobernabe96@gmail.com (K.B.-B.)

² Departamento de Bioquímica y Medicina Molecular, Facultad de Medicina, Universidad Autónoma de Nuevo León, Monterrey 64460, Mexico; celia.sanchezdm@uanl.edu.mx (C.N.S.-D.); carriongarcia.paola@gmail.com (P.Y.C.-G.); alberto.roachoprz@uanl.edu.mx (J.A.R.-P.); elsa.garzatr@uanl.edu.mx (E.N.G.-T.)

³ Departamento de Genética, Facultad de Medicina, Universidad Autónoma de Nuevo León, Monterrey 64460, Mexico

* Correspondence: hugo.gallardobl@uanl.edu.mx (H.G.-B.); margarita.sanchez@cimav.edu.mx (M.S.-D.)

[†] These authors contributed equally to this work.

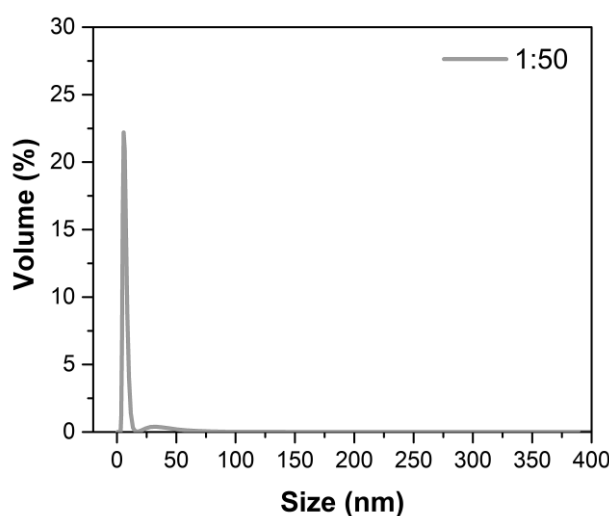


Figure S1. Size distribution of AuNPs@MG at 1:50 weight ratio (W_{MG}/W_{Au}).

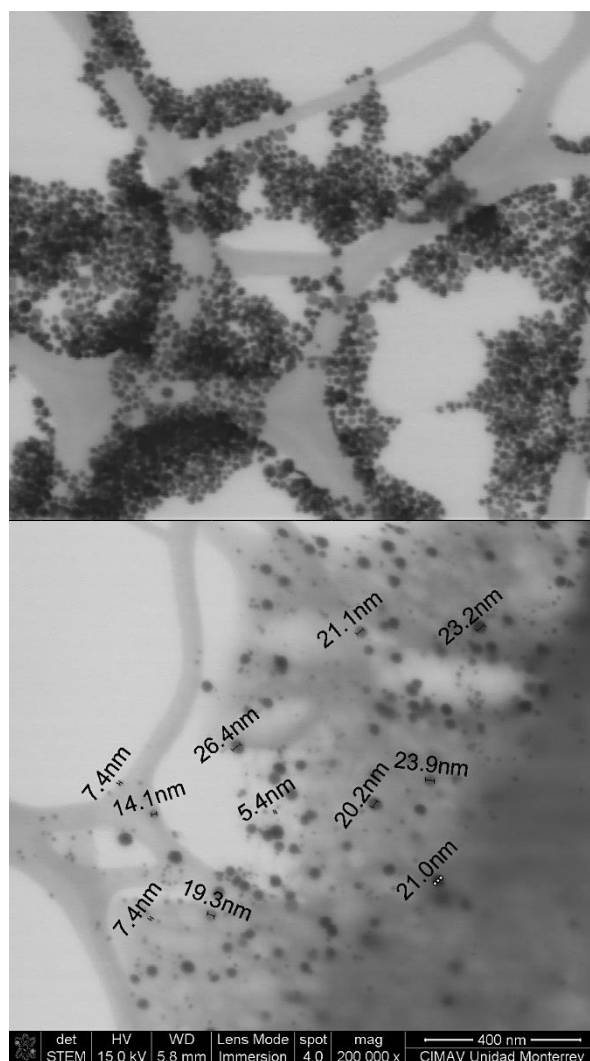


Figure S2. STEM Micrographs of AuNPs@MG obtained at a 1:15 weight ratio.

Table S1. Comparison of the synthesis of AuNPs using AG reported in the literature and the method reported here.

Authors	Reducing and stabilizing agent	Reaction time	Temperature	Shape/ Average particle size	Observations	Reference
Pinilla et al.	Mesquite gum	180 min	70°C	Globular NPs/18.3±7.3	We do not use toxic reducing and stabilizing agents Stable at physiological conditions (PBS) Biocompatible. Hemocompatible	This work
Ribeiro de Barros et al.	NaBH ₄ (reducing agent) Arabic gum (Stabilizing agent)	60 min	Room temperature	Spherical/ 5.4 nm	It is necessary to leave the mixture overnight at 4°C to ensure complete hydration of the gum. Hemocompatibility was not evaluated. NaBH ₄ was used and it is cytotoxic.	[1]
Gamal-El-deen et al.	P(CH ₂ NHCOOH) ₃ (Reducing agent) Arabic gum (Stabilizing agent)	10 min	80 °C	Spherical/ 21 nm	An additional chemical compound was used to reduce the gold. Stability over time under physiological conditions was not evaluated Hemocompatibility was not evaluated	[2]
Wu et al.	Arabic gum	240 min	55°C	Spherical/ 26.8nm	Stability over time under physiological conditions was not evaluated. Hemocompatibility was not evaluated	[3]
Iranpour et al.	Ionic liquid D-glucosammonium	20 min	60 °C.	Spherical/ 25 nm	Ionic liquids are relatively high cost compared to other reducing agents.	[4]

	formate (Reducing agent)				Hemocompatibility was not evaluated.	
	Arabic gum (Stabilizing agent)					
Gonçalves et al.	NaBH ₄ Ascorbic acid (Reducing agents) CTAB Arabic gum (Stabilizing agents)	360min	Room tem- perature	Rods	CTAB and NaBH ₄ are cytotoxic Long reaction time. Hemocompatibility was not evaluated.	[5]

References

1. Ribeiro, de Barros H, Cardoso, MB, Camargo de Oliveira, C, et al (2016) Stability of gum arabic-gold nanoparticles in physiological simulated pHs and their selective effect on cell lines. *RSC Adv* 6:9411–9420. <https://doi.org/10.1039/C5RA24858B>
2. Gamal-Eldeen AM, Moustafa D, El-Daly SM, et al (2016) Photothermal therapy mediated by gum Arabic-conjugated gold nanoparticles suppresses liver preneoplastic lesions in mice. *J Photochem Photobiol B* 163:47–56. <https://doi.org/10.1016/j.jphoto-biol.2016.08.009>
3. Wu C-C, Chen D-H (2010) Facile green synthesis of gold nanoparticles with gum arabic as a stabilizing agent and reducing agent. *Gold Bull* 43:234–240. <https://doi.org/10.1007/BF03214993>
4. Iranpour P, Ajamian M, Safavi A, et al (2018) Synthesis of highly stable and biocompatible gold nanoparticles for use as a new X-ray contrast agent. *J Mater Sci Mater Med* 29:48. <https://doi.org/10.1007/s10856-018-6053-5>
5. Gonçalves JP, da Cruz AF, Nunes ÁM, et al (2021) Biocompatible gum arabic-gold nanorod composite as an effective therapy for mistreated melanomas. *Int J Biol Macromol* 185:551–561. <https://doi.org/10.1016/j.ijbiomac.2021.06.172>