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Plant-mediated Green Synthesis and Biological Activities of Polysaccharide Nanoparticles Through Top-Down Approach

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INTRODUCTION

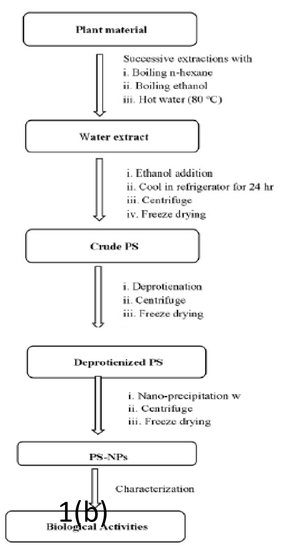
Due to their biocompatible and biodegradable nature and their medicinal properties, polysaccharides nanoparticles (Ps-NPs) have drawn significant attention. Polysaccharides nanoparticles are used in targeted drug delivery, wound healing, catalysis, biosensing, and agents with antiviral, antimicrobial, anticancer, antibacterial and antifungal, capabilities [1,2]. The current work deals with synthesis of nanoparticles based on polysaccharides extracted from the plant *Rosa webbiana (local name Palwari)* and evaluation of their biological properties.

EXPERIMENTAL

The plant *R. webbiana* was collected from local area of district Buner (Pir Baba) KPK, Pakistan in the month of March 2018. The plant material was extracted with n-hexane, ethanol and hot water method as shown in figure. Polysaccharide from the plant were extracted by precipitating with ethanol and deprotienized by HCL method.

Nanoprecipitation is a process in which Ps-NPs can be prepared.

1(a)



1(b)

Figure 1(a). Photographic illustration of *R. webbiana* **1(b).** Schematic diagram for the synthesis of polysaccharide nanoparticles.

RESULT AND DISCUSSION

The shape and particle size of Ps-NPs were observed by SEM as shown in fig 2.Mostly shape of nanoparticles were spherical with different sizes but a minute amount of anisotropic nanostructures such as nano-triangles, nanorods and a number of hexagonal and polygonal nanomaterials were also found out.

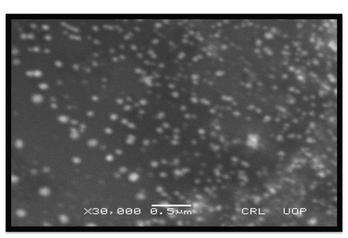
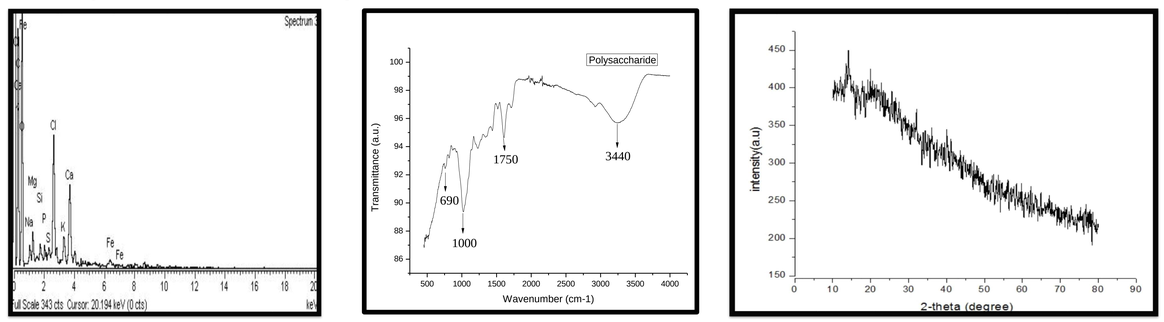


Figure 2. SEM images of Ps-NPS.



a b c

Figure 3. (a) EDX of Ps-NPs (b) FT-IR spectra of polysaccharides (c) XRD spectrum of Ps-NPs

As shown in the figure 3(a) EDX of the Ps-NPs committed the existence of C, O and N confirms polysaccharides. In fig 3(b) FTIR spectra shows OH, C≡C, C=C and C-H confirmed polysaccharides. While in fig3(c) XRD shows the nanoparticle size which is 0.15nm.

Table 1 and 2: Antioxidant and Antibacterial activity of polysaccharides and its nanoparticles.

Sample	Concentration	Percent scavenging effect	IC_{50}(µg/mL)
Ps-60	1000	51.66±2.51	40
	500	43.33±1.52	
	250	40.66±2.08	
	125	35.33±3.05	
Ps-70	1000	48.33±2.51	42
	500	40.66±1.52	
	250	38.33±1.58	
	125	34.45±2.53	
Ps-80	1000	86.33±2.51	19
	500	85.33 ±3.51	
	250	76.33±2.67	
	125	63.34 ±2.64	
Np-1	1000	23±3.05	60
	500	19±2	
	250	16±2	
	125	14±3	
Np-2	1000	84.83±3.05	25
	500	70.35±2.08	
	250	67.25±3.05	
	125	61.12±2.51	
Ascorbic acid	1000	90.51±0.53	10
	500	83.50±0.65 80.81±0.53	
	250	70.65±0.43	
	125		

Table 1

Zone of inhibition (positive Bacteria mm) against Gram			Zone of inhibition (mm) against Gram negative Bacteria			
Samples	Staphylococcus Epidermidis	S.aureaus	E.faecleis	S.typhi	E.coli	Pseudomonas argenuosa
	0.1 mg/ml 0.2 mg/ml	0.1 mg/ml 0.2 mg/ml	0.1 mg/ml 0.2 mg/ml	0.1 mg/ml 0.2 mg/ml	0.1 mg/ml 0.2 mg/ml	0.1 mg/ml 0.2 mg/ml
Ps-60	11	10	14	17	20	24
Ps-70	7	12	15	23	25	29
Ps-80	8	13	18	22	26	32
Np-1	11	13	16	23	29	34
Np-2	18	9	16	30	34	39
Ceftriaxone	3	7	15	47	51	54

Table 2

The ps-60,ps-70,ps-80, np-1 and np-2 shows weak anti-bacterial activity against gram positive bacteria as compared to gram negative bacteria. The better result can be shown by np-2 as shown in table 2.

Ps-80 shows the highest antioxidant activity as shown in table 1.

CONCLUSIONS

Polysaccharides based nanoparticles were synthesized and characterized. The synthesized nanoparticles indicated strong antimicrobial activities. It is efficient and with green energy extend the generation of Ps-NPs an industrial scale Thus the present studies revealed that using polysaccharide nanoparticles have various application in the area of nanomedicine, catalysis and drug delivery etc.

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