

Antibacterial Activities of Nanoparticles from Foliose Lichens: A Review

Mamta Bhat

Department of Botany, School of Biosciences and Biotechnology,
BGSB University, Rajouri – 185 234
E-mail: mamtabhat12oct@gmail.com

Abstract—Lichens have been used since ancient times against numerous diseases and for the improvement of human health. Besides lichens play an important role in succession and as biomonitors and bioindicators. All the different growth forms of lichens such as crustose, squamulose, foliose and fruticose have been used by man in one way or the other as food, fodder, dyes, perfumeries and even cosmetics. Some of the lichens are highly significant for pharmaceutical purposes due to presence of secondary metabolites in them. Over 500 secondary metabolites have been extracted from different lichens and many among them possess remarkable therapeutic properties.

Now a days, nanoparticles are being synthesized successfully from many foliose lichens through biotechnological interventions. These nanoparticles extracted from lichens possess significant antibacterial properties. Therefore, the present communication summarizes an account of antibacterial uses of nanoparticles isolated from foliose lichens worldwide.

1. INTRODUCTION

Lichens are formed by the symbiotic association between the algae (photobiont) and the fungi (mycobiont). This mutualistic association is beneficial for both the partners as the algae prepares food due to presence of chlorophyll and in turn fungus provides shelter to algae and also absorbs water and nutrients from the soil [1]. Lichens are one of the most important organisms both ecologically as well as economically. They are the pioneers in the ecological succession [2]. Lichens are highly sensitive to the atmospheric pollutants and are unable to grow in polluted areas, therefore, they act as the essential environmental indicators [3]. Their economic significance is vivid by the range of phenolic compounds such as depsides, depsidones, terpenes, xanthenes, anthraquinones [4] and as such several potent drugs have been extracted from them to cure several ailments.

Lichens are known to possess certain anticancerous properties [5]. Antioxidant and anti-aging agents have also been extracted from them [6]. Lichens also possess antimicrobial properties e.g., the methanol extracts of lichen species *Parmelia centrifuga* and *Ochrolecia tartaea* have confirmed both antibacterial and antifungal properties [7]. Lichens are also put to use for the production of Silver nanoparticles

especially by following cost effective and ecofriendly approaches [8]. These Silver nanoparticles isolated from lichens exhibited antibacterial activity against human pathogenic bacteria [9].

2. ANTIBACTERIAL USES

Silver nanoparticles (with average particle size of 19 nm) extracted from aqueous extracts of *Parmotrema parasorediosm* showed antibacterial activity against Gram negative bacteria namely *Proteus vulgaris*, *Serratia marcescens*, *Staphylococcus aureus*, *Bacillus subtilis*, *Pseudomonas aeruginosa*, *Salmonella typhi*, *Staphylococcus epidermidis* and *Streptococcus faecalis* [10].

However, silver nanoparticles synthesized from *Punctelia subrudecta* showed potent antibacterial as well as antioxidant properties [11].

3. CONCLUSION:

The role of biotechnological interventions can play a positive role for the massive production of bioactive silver nanoparticles from different types of lichens. This in turn could be utilized in the field of medicine positively.

4. ACKNOWLEDGEMENTS

The author is thankful to the Head, Department of Botany, Baba Ghulam Shah Badshah University for providing necessary lab. facilities.

REFERENCES

- [1] Ahmadjian, V. "The Lichen Symbiosis". John Wiley & Sons, New York, NY, USA, 1993.
- [2] Taylor, T. N., Hass, H., Remy, W. and Kerp, H. "The oldest fossil lichen". *Nature*, 1995. 378, 244.
- [3] Richardson, D. H. S. Lichens as pollution indicators in Ireland in Biological indicators of pollution. Dublin: Royal Irish Academy. 1987.
- [4] Halama, P. and Van Haluwin, C. "Antifungal activity of lichen extracts and lichenic acids" *Biont.*, 2004. 49:95-107.

-
- [5] Shrestha, G. and St. Clair, L. L. "Lichens: a promising source of antibiotic and anticancer drugs". *Phy, Phytochem Rev*, 2013. 12:229.
- [6] Ames, B. N., Shingenaga, M. K. and Hagen, T. M. "Oxidants, antioxidants and the degenerative diseases of aging". *Proceedings of National Academy of sciences of the United States of America*, 1993.901:7915-7922.
- [7] Branislav, R., Marijana, M. and Slobodan, S. "Antimicrobial activity of extracts of the lichens *Cladonia furcata*, *Parmelia caprata*, *Parmelia pertusa*, *Hypogymnia physodes* and *Umbilicaria polyphylla*" *Biologia*, 2009. 64/1:53-58.
- [8] Mie, R., Samsudin, M. W., Din, L. B., Ahmad, A., Ibrahim, N., and Adnan, S. N. A. "Synthesis of silver nanoparticles with antibacterial activity using the lichen *Parmotrema praesorediosum*". *International Journal of Nanomedicine*, 2014; 9: 121-127.
- [9] Gunasekaran, S., Rajan, V. P., Samsudin, M. W., Din, L., Ramanathan, S. and Vikneswaran Murugaiyah. "Antibacterial activity of lichen *Usnea rubrotincta*, *Ramalina dumeticola*, and *Cladonia verticillata*", *AIP Conference Proceedings*, 2015. 1678.
- [10] Mie, R., Samsudin, M. W., Din, L. B. and Ahmad, A. "Green Synthesis of Silver Nanoparticles Using Two Lichens Species: *Parmotrema praesorediosum* and *Ramalina dumeticola*" *Applied Mechanics and Materials*, 2012 Vols. 229-231, pp. 256-259.
- [11] Subramanyam, D., Suresh, K. A., Mani, R., Siva Reddy, Samba, C. Hemalatha, C. S., Wudayagiri, R. and Lokanatha, V. "Biosynthesis, Characterization, Antibacterial and Antioxidant Activity of Silver Nanoparticles Produced by Lichens". *Journal of Bionanoscience*, 2013 Volume 7, Number 3, pp. 237-244(8).