World Academy of Science, Engineering and Technology
International Journal of Pharmacological and Pharmaceutical Sciences
Vol:13, No:09, 2019

The Application of Whole-Cell Luminescent Biosensors for Assessing Bactericidal Properties of Medicinal Plants

Authors : Yuliya Y. Gavrichenko

Abstract : Background and Aims: The increasing bacterial resistance to almost all the available antibiotics has encouraged scientists to search for alternative sources of antibacterial agents. Nowadays, it is known that many plant secondary metabolites have diverse biological activity. These compounds can be potentially active against human bacterial and viral infections. Extended research has been carried out to explore the use of the luminescent bacterial test as a rapid, accurate and inexpensive method to assess the antibacterial properties and to predict the biological activity spectra for plant origin substances. Method: Botanical material of fifteen species was collected from their natural and cultural habitats on the Crimean peninsula. The aqueous extracts of following plants were tested: Robinia pseudoacacia L., Sideritis comosa, Cotinus coggygria Scop., Thymus serpyllum L., Juglans regia L., Securigera varia L., Achillea millefolium L., Phlomis taurica, Corylus avellana L., Sambucus nigra L., Helichrysum arenarium L., Glycyrrhiza glabra L., Elytrigia repens L., Echium vulgare L., Conium maculatum L. The test was carried out using luminous strains of marine bacteria Photobacterium leiognathi, which was isolated from the Sea of Azov as well as four Escherichia coli MG1655 recombinant strains harbouring Vibrio fischeri luxCDABE genes. Results: The bactericidal capacity of plant extracts showed significant differences in the study. Cotinus coggygria, Phlomis taurica, Juglans regia L. proved to be the most toxic to P. leiognathi. (EC50 = 0.33 g dried plant/l). Glycyrrhiza glabra L., Robinia pseudoacacia L., Sideritis comosa and Helichrysum arenarium L. had moderate inhibitory effects (EC50 = 3.3 g dried plant/l). The rest of the aqueous extracts have decreased the luminescence of no more than 50% at the lowest concentration (16.5 g dried plant/l). Antibacterial activity of herbal extracts against constitutively luminescent E. coli MG1655 (pXen7-lux) strain was observed at approximately the same level as for P. leiognathi. Cotinus coggygria and Conium maculatum L. extracts have increased light emission in the mutant E. coli MG1655 (pFabA-lux) strain which is associated with cell membranes damage. Sideritis comosa, Phlomis taurica, Juglans regia induced SOS response in E. coli (pColD-lux) strain. Glycyrrhiza glabra L. induced protein damage response in E. coli MG1655 (pIbpA-lux) strain. Conclusion: The received results have shown that the plants' extracts had nonspecific antimicrobial effects against both E. coli (pXen7-lux) and P. leiognathi biosensors. Mutagenic, cytotoxic and protein damage effects have been observed. In general, the bioluminescent inhibition test result correlated with the traditional use of screened plants. It leads to the following conclusion that whole-cell luminescent biosensors could be the indicator of overall plants antibacterial capacity. The results of the investigation have shown a possibility of bioluminescent method in medicine and pharmacy as an approach to research the antibacterial properties of medicinal plants.

Keywords : antibacterial property, bioluminescence, medicinal plants, whole-cell biosensors
Conference Title : ICPPNP 2019 : International Conference on Pharmacognosy, Phytochemistry and Natural Products
Conference Location : London, United Kingdom
Conference Dates : September 25-26, 2019