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Inhibition of Bacterial Quorum-Sensing by *Ferula asafoetida* Essential Oil

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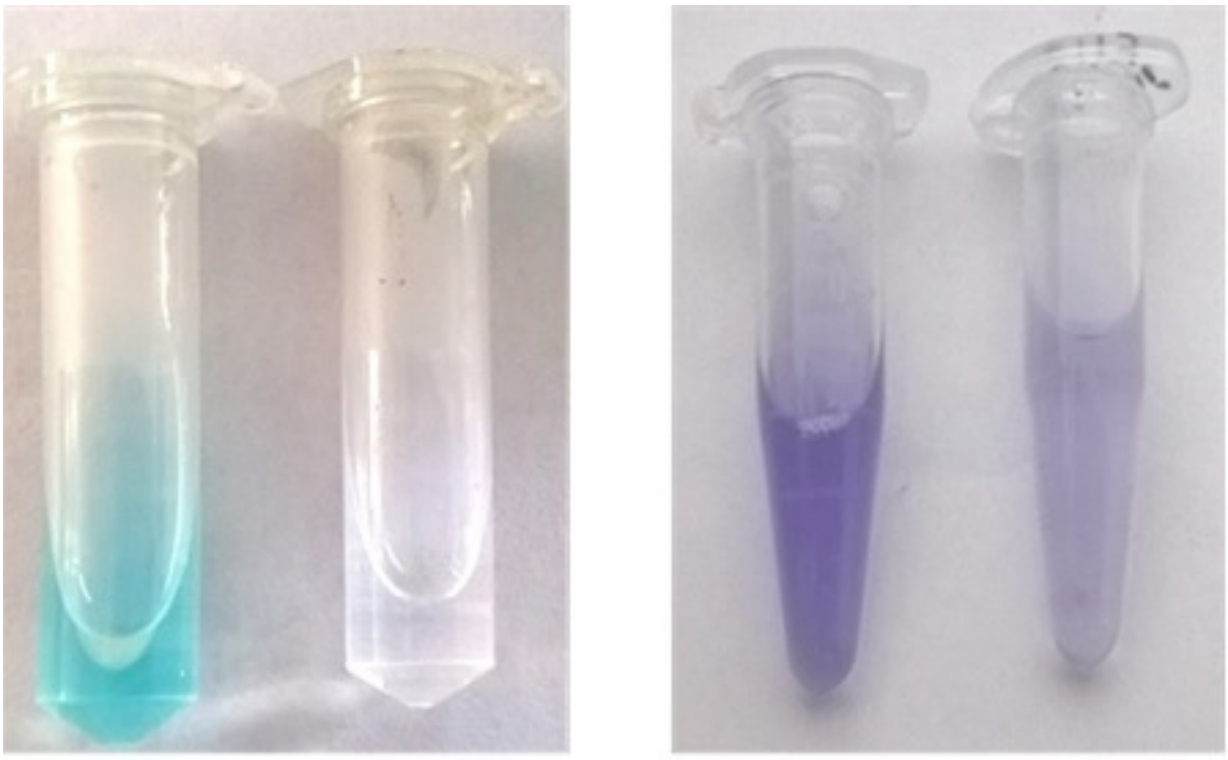
Image Article



Left side vials in both frames contain pigment extracted from the 'control' tube, where organism is not exposed to the test oil; whereas right side vials contain pigment extracted from the oil exposed bacterial culture. In both cases, the magnitude of pigment inhibition was near to 87%. Images shown are only for the highest concentration tested against each organism.

A. Reduced production of the blue pigment pyocyanin by *P. aeruginosa* under influence of oil (2 %v/v)

B. Reduced production of the pigment violacein by *C. violaceum* under influence of oil (3 %v/v)

Figure 1: Quorum sensing-inhibitory effect of essential oil of *Ferula asafoetida.*

Pathogenic bacteria develop antibiotic-resistance at a pace much faster than the pace at which new antimicrobials can be discovered and introduced into the market. The process of new drug development demands identification of novel targets in the pathogenic population. Conventional antibiotics have largely targeted bacterial cell wall synthesis, protein synthesis, or nucleic acid synthesis. However in recent years, quorum sensing (QS) machinery of the pathogenic bacteria has received considerable attention as potential target of novel anti-infective agents. QS is the mechanism through which microbial populations modulate their behaviour in a cell-density dependent fashion. In many of the pathogenic bacteria, a considerable number of their genes (including those associated with virulence) are QS-regulated. As pigment production in many of the pathogenic bacteria like, *Staphylococcus aureus, Pseudomonas aeruginosa* etc. is controlled by QS, understanding the genetics underlying pigment production becomes important in clinical context. For example, in *Chromobacterum violaceum*, production of the violet pigment violacein is under regulation of the *vio* operon; and the region of its genome coding for one of the important virulence traits i.e. haemolysis is located very much near to this *vio* operon. Screening assays for identifying novel QS-inhibitors find pigment production as one of the most convenient test parameters.

Figure 1 displays results of our preliminary investigation on QS-inhibitory potential of the *Ferula asafoetida* essential oil extracted from its latex employing a microwave based extraction method. This oil was able to reduce QS-associated production of the purple pigment violacein in *Chromobacterium violaceum*; and the blue pigment pyocyanin in *Pseudomonas aeruginosa*. Pyocyanin is one of the virulence factors of the notorious bacterium *P. aeruginosa* [1]. The operon which regulates production of violacein contains five genes *vio* A-E [2]. Pyocyanin is synthesized from chorismate by the *phz* operons, and the pathway involved is positively regulated by the transcriptional activator MvfR (PqsR) through the synthesis of quorum-sensing quinolone molecules [3].

Information regarding the genetics of pigment production in bacteria can be helpful in formulating novel anti-virulence strategies to reduce production of QS-regulated virulence factors including pigments. Screening exercises for Identification of the natural products possessing potent QS-modulatory property may result in finding novel leads for development of new anti-infectives.

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