

Pseudomonas sp. with high homology to *Pseudomonas selenii praecipitans*. These results suggested that isolated bacterial strain could have potential to be developed into inoculums for improved Fe and Mn simultaneous removal in water treatment systems.

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* *This work was supported by SIDA grant to University of Rwanda, 2016.*

УДК 606

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METABOLIC ENGINEERING OF SECONDARY METABOLITE PATHWAY IN HIGHER PLANTS AND MICRO-ALGAE FOR THE PRODUCTION OF DESIRABLE METABOLITE- PROFILES OF COMMERCIAL VALUE

Keywords: RNAi technology, *N*-methyltransferase, *cyanobacterium* – *Spirulina*, astaxanthin.

Secondary metabolites are of great commercial importance for food, medicines, health care products, and as chemicals of multiple utilities. The advancement of the understanding of the pathway of secondary metabolites and the aspects of functional genomics of specific steps have enhanced our ability to manipulate the production of metabolites in the desired manner. It also provides opportunities to produce novel metabolites through gene regulation and synthetic biology approaches to produce new and novel compounds of commercial importance. Our studies on the pathway engineering of coffee plants through antisense gene or RNAi technology have led to the

production of novel traits such as reduced caffeine production in *Coffea canephora* plants. Through this technology, the lowered expression of N methyltransferase, responsible for caffeine production, was achieved. This technology provides an alternative to solvent mediated decaffeination process. Introduction of novel gene for Δ -6-desaturase from cyanobacterium -*Spirulina* into soybean resulted in formation of γ linolenic acid in this crop, enhancing the nutritional value of the soybean oil. In another study the production of novel metabolite such as astaxanthin- a carotenoid of high commercial value was achieved by cloning the gene for beta-carotene ketolase and hydroxylase from a green alga - *Haematococcus pluvialis* and expressing the same in β carotene rich halotolerant alga- *Dunalliella*. The novelty of this study lies in producing new molecule astaxanthin from its precursor β carotene in easily cultivable form of alga thus finding an alternate source of production of this wonderful molecule of versatile health benefits. Astaxanthin is potent antioxidant, anticancer agent and also exhibits antiulcer properties, hence molecules of high demand. We have also worked on the pathway of capsaicin (a pungent principle of green pepper) and identified the gene for vanillylamine- aminotransferase. Alterations in the pathway of capsaicin in favour of vanillyl alcohol formation instead of vanillylamine is reported to produce capsinoids which are non pungent and potent anti obesity molecules. The condensation of vanillyl alcohol with fatty acid pathway, especially with that of 8- methyl nonanoic acid, leads to the formation of capsinoids. Similarly, synthetic biology approach to produce high value metabolites in yeast has been demonstrated to produce them in industrial scale. The technologies that are adopted for pathway engineering for achieving desired metabolite production in situ will be discussed for commercial applications based on our studies and from published literature to provide global perspectives.