

UMP. 742

Potential of plant biologics to tackle the epidemic like situations - case studies involving viral and bacterial candidates

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Background: The art of recombinant protein production in *E.coli* and mammalian system needs an extensive infrastructure to adopt GMP practice for large-scale production and this makes the final product very expensive and such therapeutics may not be affordable where it is needed the most. The potential of plant biologics over the conventional systems is, it has glycosylation pattern or with a choice of non-glycosylation containment i.e. in chloroplast, established genetic and glycoengineering methods, adaptability, scalability and affordability. Plant molecular farming in simple words 'the use of plants for the production of protein therapeutics' became popular due to the Magnifaction technology, degenerative vectors and glycoengineered plants. Our studies involved the usage of current technology for expression and purification of Chikungunya vaccine candidates and mAb's in plant system and also manifests the compatibility of plant host system for the expression of *S.aureus* superantigenic proteins with the proven immunogenic functions.

Methods & Materials: The CHIKV vaccine candidates *E1* and *E2*, bacterial superantigenic peptides *TSST-1* and fusion gene *rTE* and anti-CHIKV mAb's (8B10 and 5F10 were retrieved from European patent application EP2374 816 A1) were cloned into the current generation high expression plant constructs like pEAQ-HT-DEST and pTRAK through gateway cloning technology and conventional cloning. Constructs were mobilized into *Agrobacterium* and vacuum infiltrated in *N.benthamiana* plants following standard procedures. Following 5th day of post infiltration leaves were harvested and recombinant protein was purified by his-tag and proteinA/G affinity based purification techniques respectively.

Results: We have successfully produced CHIKV vaccine candidates *E1* and *E2* (8-13 mg/kg of fresh leaf weight), antibodies (20-30 mg/kg) and the bacterial recombinant superantigen *TSST-1* and hypothetical vaccine candidate *rTE* fusion proteins (5.4 and 6.7 mg/kg). The *in vivo* and *in vitro* immunogenicity and neutralization studies revealed that the plant produced antigens and antibodies elicit good immune responses.

Conclusion: The level of expression, glycosylation and immunizing potential are the evidence strongly suggesting the plants are the potential alternate system. So, we propose plant biologics as a promising system during an epidemic like situation as scale-up of this system is infinity at an affordable cost, which will help the people, where it is needed the most.

<https://doi.org/10.1016/j.ijid.2018.04.4236>