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SHORT COMMUNICATION

Plantibodies: The plant pharmaceuticals

Parameswara Reddy A*

Vignan Pharmacy College, Guntur, India

*Correspondence to: Parameswara Reddy A, Email: parameswar.reddy864@gmail.com

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Introduction

What the plantibody says ?

Iam a portmanteau derived from a plant and an antibody endo membrane and secretory systems- clinically viable proteins Pathogen resistance.

Why produced in plants?

- Single secretory cell- Fully functional antibodies
- Reduce the risk of human contamination
- Lower upstream production cost
- Unlimited amounts of proteins & simplified purification
- More efficient & devoid of side effects-completely a novel technology

Why Not in others?

- Mammals require numerous cell types
- Ex:plasma cells-dimerising J chain epithelial cells-secretory component
- Frequently found in Microbial and animal cultures.
- Animal cell cultures-expensive growth media
- limited post translational Microbial cultures- modification of eukaryotic proteins & purification is often difficult
- The magic bullets (MCAb) in mice- give severe allergic reactions to human.

HOW are antibodies expressed in plants?

As either whole antibodies or as smaller fragments ScFv's(Single chain Fragment variables).

Whole antibodies: more therapeutic potential more resistant to proteolysis

ScFv's: easily targeted to sub-cellular compartments, efficient targets of specific pathogen proteins.

Methods

Transgenic methods:

- *Agrobacterium tumefaciens* mediated gene transfer:
  - Transmits Ti plasmid into infected plant
  - Desired genetic code inserted in place of Ti plasmid
- Electroporation:
  - Cell wall pores opened by an electric shock
  - DNA inserted Biolistics (particle bombardment-gene gun):
  - Shooting a piece of DNA into the plant tissues
  - Tiny gold or tungsten balls covered with coded genetic material
  - Simple laboratory technique
  - For both mono & dicotyledenous plants

Non-transgenic methods

- Recombinant virus infection:
  - Similar to agrobacterium gene transfer
  - Only difference is genetically modified material is not inserted into plant genome
  - R.V causes the expression of the genetically induced protein eg: TMV
- Increased gene expression via promoter modulation
  - Through modulation of proteins
  - Over express the gene-results in more of the desired protein

How to obtain high amount of antibody production?

Targeting the proteins into apoplast – most efficient

- Apoplasm is lack of hydrolytic enzymes
- Seeds:

- Retain high protein levels
- Can be preserved for long time

Developed more in Corn. Why?

- Seed kernels capable of storing plantibodies in a low moisture environment
- High concentration of protease inhibitors
- Can be purified by simple milling technique
- Staple food crop of many countries

Are the plantibodies so beneficial?

YES. . . . .

- Better than other transgenic foods
  - * edible vaccines for immuno deficiency patients
  - * nutrition foods (NEUTRACEUTICALS)no protein denaturation long storage
- Low cost
- Efficient transformation
- Correct assembly of multimeric proteins
- Safety-does not pose the risk of spreading human

Applications

Human applications

Treatment of dental caries:

- Caused by Streptococcus mutans
- Plantibodies from tobacco plants-proved t provide protection upto 4 months
- Inhibit bacterial attachment to the tooth surface
- Prevent colonisation in the human body
- Opsonises the S.mutans facilitating phagocytosis
- Treatment of STD's:
- Genital herpes:
- With a topical gel containing plantibodies against herpes type1&2 viruses
- Proved to be effective when applied to the vagina of mice
- Anti-HSV (Herpes simplex virus)
- Produced in soya beans
- Anti-HIV (Human immuno deficiency virus)

Plant applications

Against virus infections:

- Other transgenic plants by expressing viral coat protein genes -interfere the viral replications
- But the risk is the presence of viral DNA sequences present in human food stuffs
- So plantibody technology is an alternative approach
- F8 antibody - Against Artichoke Mottled Crinkle Virus (AMCV) coat protein - in Nicotiana benthamiana
- Against nematodes:
- Enzymes in the saliva – targets for plantibodies
- Prevent root localisation
- Interfere with the formation and maintenance of the feeding site of nematodes
- Target the proteins that initiates the nematode cell cycle

Achievements

Epicyte – presently clinical trails

- Exclusive licence for plantibody technology
- Topical gel against herpes 1&2 virus
- Treatment of dental caries in Rhesus monkeys
- F8 plantibodies against AMCV
- Hepatitis B –virus in tobacco plants being investigated
- Topical gel against HSV in soya beans.

Scope and Future

- Plants : factory systems for the production of monoclonal antibodies
- Medication A solution to problematic in under devoloped nations
- Formulation of plantibody based topical contraceptives
- Investigations about
  - o acute pulmonary infection- by Respiratory Synctial virus
  - o Diarrohea – by Clostridium difficille
  - o Hope to produce plantibodies against HIV – the major threat to the world human life.

Conclusion

- Production of plantibodies in plants has numerous applications not only in the pharmaceutical industries but also the plant breeder
- The plantibody technology holds a lot of promise for the future hopefully contributing to the treatment of many diseases.