Engineering Solutions for Addressing Global Malnutrition

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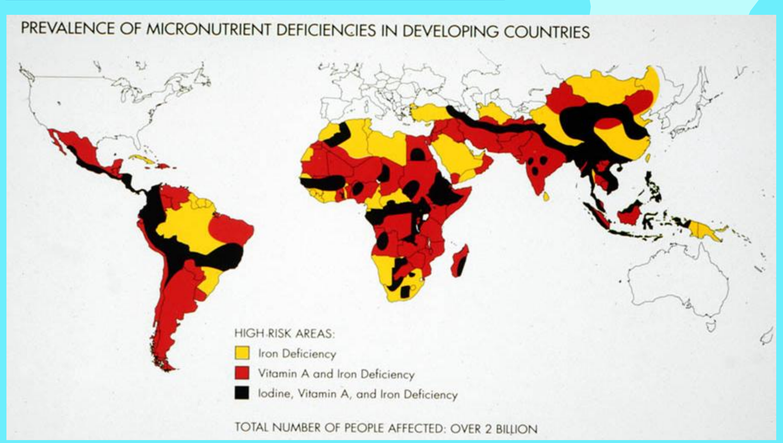
INTRODUCTION

Global micronutrient malnutrition affects over 1/3 of the world's population, mainly in developing countries. Three major issues have been identified by WHO as the following :

- Vitamin A deficiency (VAD)
- Iron deficiency anemia (IDA)
- Iodine deficiency disorder (IDD)

Food fortification has been recognized as more cost-effective intervention than supplementation or diet modification. Despite the relatively small quantities of vitamins and minerals required, there are major **technical challenges** in their safe and effective delivery. Innovative technologies are required to ensure the stability of added micronutrients through processing, distribution, retail and food preparation, and ultimately to ensure their effective delivery to the body in safe, bioavailable forms.

Microencapsulation technologies promise to fulfill all these technical needs.



RESEARCH APPROACH

Micronutrients → **Direct fortification** (surface coating or powder blending) → **Staple Foods**

Premix form with matching size, colour, shape, appearance, and density

Microencapsulation-based Technology

(Particle agglomeration by extrusion + Surface modification)

EXPERIMENTAL METHODS

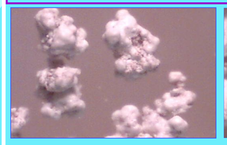
KitchenAid mixer

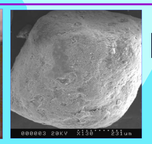
Die plate

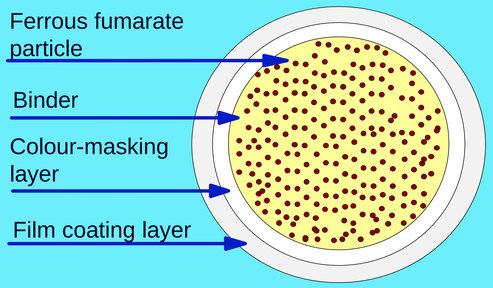
Pasta extruder

The microencapsulation-based approach has been successfully combined with Double Fortified Salt (DFS) and Ultra Rice® technologies for delivering multiple micronutrients to staple foods with nutrient-fortified premixes made by extrusion, which matches the shape, size, and appearance of common rice kernels or table salt grains.

Iron Premix for Double Fortified Salt (DFS)



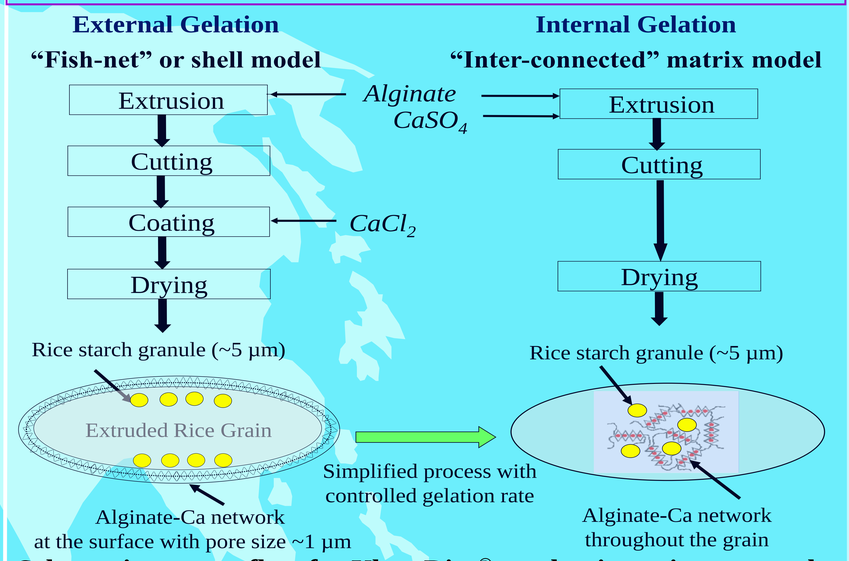




Desired properties:

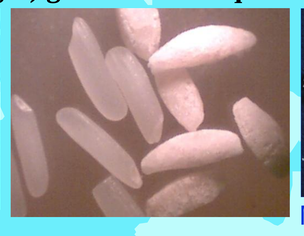
- Salt grain-sized granule
  - 300-700 µm
  - Dense texture
- Desirable colour
- Enhanced stability
- Reduced reactivity
- Unaffected iron digestibility
- Rich in iron

Ultra Rice® for Rice Fortification



Schematic process flow for Ultra Rice® production using external (left) and internal (right) gelation techniques

Vitamin A formula



Multiple-iron formula (iron, zinc, 3 B-vitamins)

CONCLUSIONS

Through the sponsorship of two International NGOs – the Micronutrient Initiative (**MI**) and the Program for Appropriate Technology in Health (**PATH**), the salt and rice platforms have been field-tested and were successful in Asia and South America. **Ultra Rice®** and **DFS** technology have been selected as 2009 and 2010 Tech Award Laureates, respectively, due to their "innovative approaches to addressing global micronutrient malnutrition" [1-2].

[1] MI: http://www.micronutrient.org/english/view.asp?x=656&id=44.
[2] PATH: http://www.path.org/news/pr090902-tech-award-laureate.php.