Longer Term Prospects for Chilled Food Waste

John Henderson

The Mini-Waste Faraday Partnership

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Approaches to waste

Re-design processes for waste minimisation

Fractionate to added value products

Stabilise, reduce, recover value (material or energy)

Stabilise, reduce in volume

Segregate

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Added value products

- Phytochemicals / nutraceuticals
- Anti-oxidants
- Colourants
- Fibres
- Vitamins
- Flavinoids
- Pectins
- Saccharides
- Carotenes

…and we call this stuff waste!

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Fractionation

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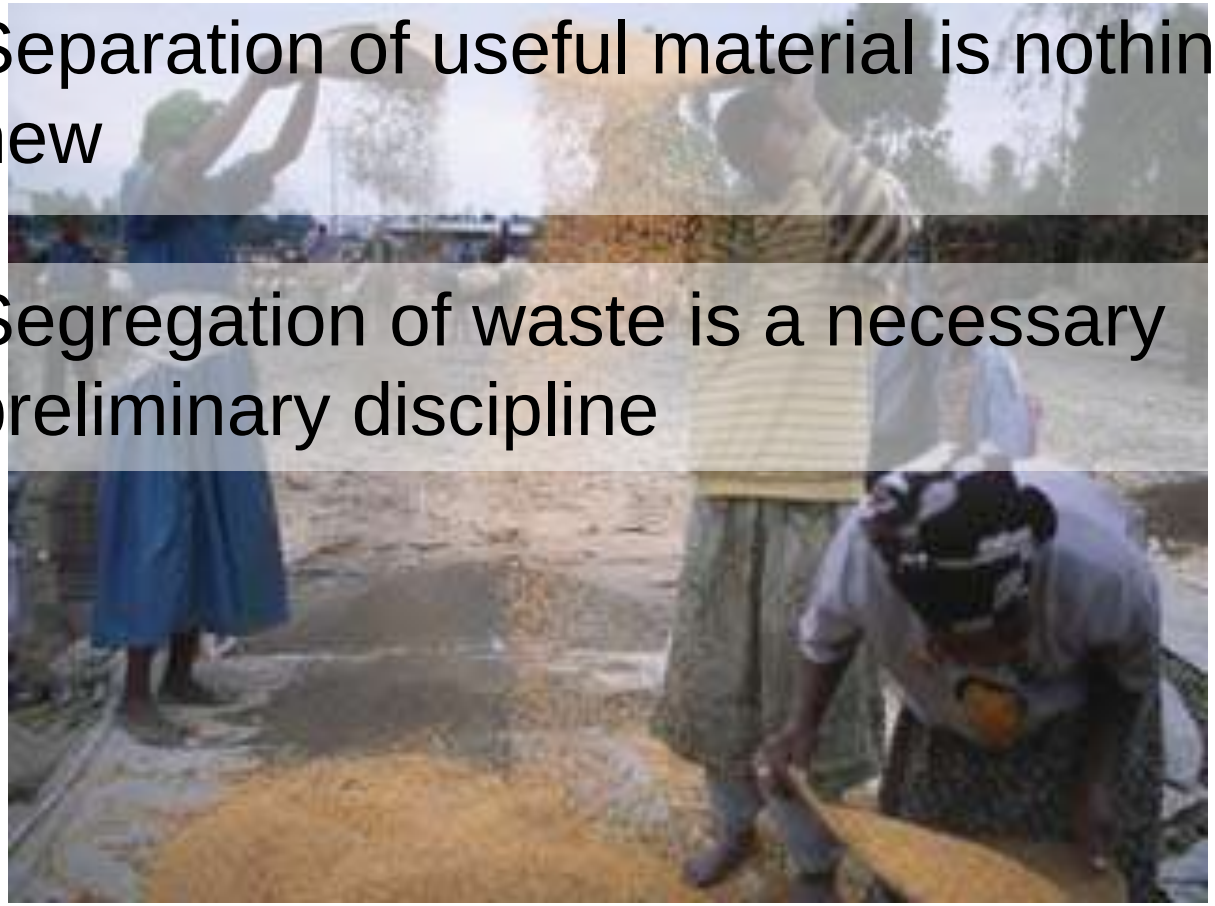
Fractionation

- Separation of useful material is nothing new

Fractionation

- Separation of useful material is nothing new
- Segregation of waste is a necessary preliminary discipline



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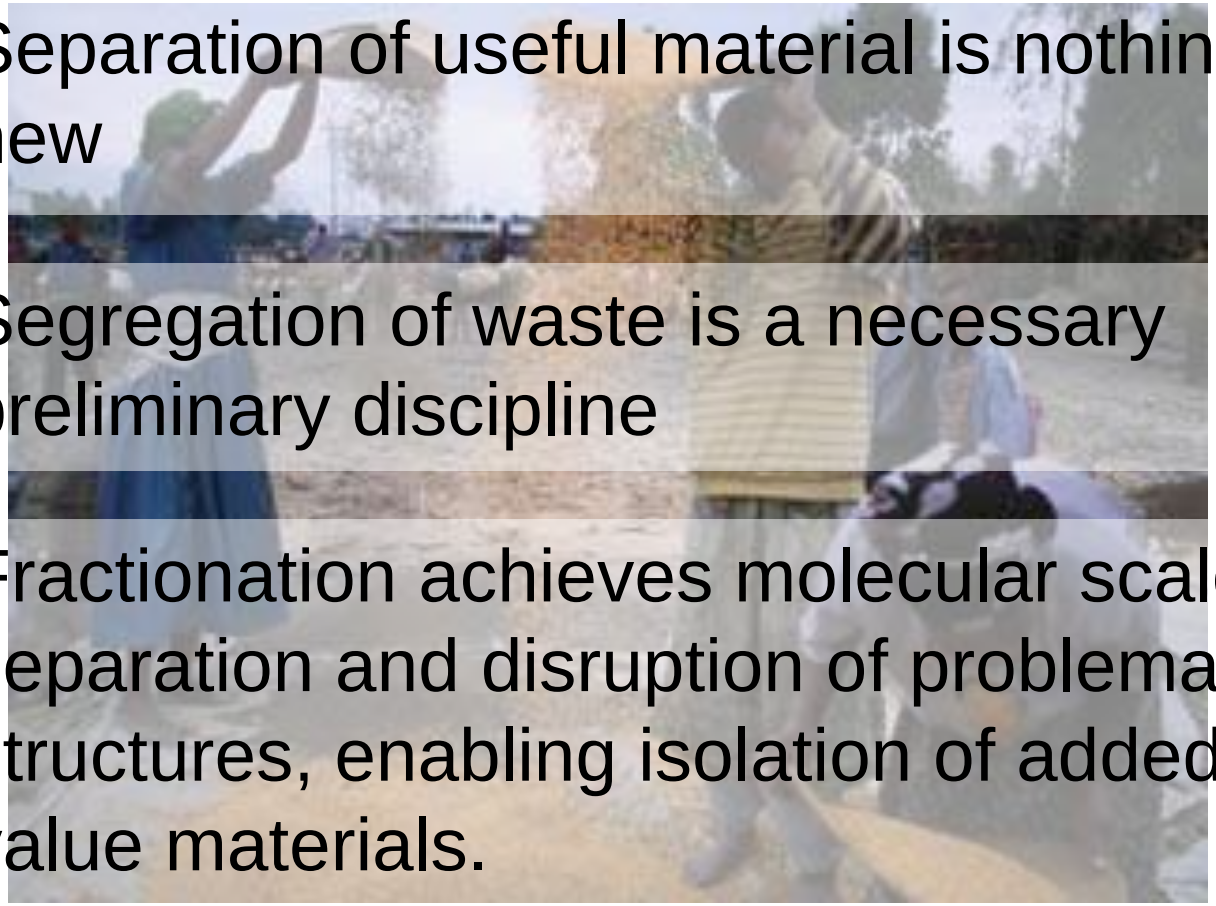
Fractionation



- Separation of useful material is nothing new
- Segregation of waste is a necessary preliminary discipline
- Fractionation achieves molecular scale separation and disruption of problematic structures, enabling isolation of added value materials.

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Routes to fractionation

- Physical
  - centrifugation, membrane separation
- Chemical
  - chemical hydrolysis, extraction
- Bio-chemical
  - enzymatic transformation.

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A few examples

Total Foods 2004, Institute of Food Research, Norwich

Phytochemicals by chemical extraction / column exchange

…from vegetable residues

F.A. Tomas-Barberan, CEBAS (CSIC) , Murcia

…from apple pomace and mango peels

A. Schieber et al., Hohenheim University

Functional foods from fish waste

E.O. Elvevoll, Univ. of Tromso

Extraction from herbs and tomato residues using supercritical CO_2

E. Vagi. B. Simandi, Budapest Univ. of Techn. And Economics

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A few examples

- Enzymatic deconstruction of cell structures to facilitate upgrading of waste

e.g. Brewer's grains, wheat bran to yield phenolic acids and fractionated polysaccharides

K.W. Waldron et al, Institute of Food Research

- Juice production from carrot waste

Provalor BV / TNO-MEP Apeldoorn

- Purification by industrial affinity chromatography

CatchMabs BV, Wageningen

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Re-design processes

- Maximise resource utilisation and avoid waste
  - Technical innovation – better unit operations
  - Information processing and decision making.

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Improved unit operations

Waste arises from the failure of processing operations.

DEFRA Advanced Food Manufacturing LINK, www.defra.gov.uk/research/link/food

Food Processing Faraday Partnership www.fpfaraday.com

- Cleanliness and hygiene
  - Surface modification AFM Project 32
  - Electrostatic fogging AFM 121
- Cutting and size reduction systems
  - Fracture mechanics AFM 79

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Improved unit operations

- Automation
  - Cutting of hot and chilled meat

    G. Purnell & S.J. James, in “Food and Drink 2000”, I. Chem E., ISBN 0 85295 438 7
  - Ingredient dispensing and placement AFM 145
  - Sandwich assembly and packaging AFM 173
- Extraction and separation
  - Separation of seafood from shells US Patent 6159258

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Improved unit operations

- Heat transfer operations
  - Better heat exchangers AFM 126
  - Surface-free heat transfer, e.g. ohmic heating

    M. Harrison, in “Electric Field Processing”, pub. Campden and Chorleywood, 2001
  - RF and microwave heating

    “Thermal Technologies in Food Processing”, Ed. P. Richardson, pub. Woodhead, 2001

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Improved unit operations

- Freezing and chilling
  - Cryogenic freezing
    P.S. Richardson & R.M. George, in "Food and Drink 2000", I. Chem E.
  - Fluidised bed technology S.L. Russell et al., ibid.
- Bacterial reduction and stabilisation
  - RF / microwave
  - ozone
  - UV
  - high pressure treatment
  - ohmic heating
  - pulsed electric fields

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Improved unit operations

- Enhanced effluent treatment
  - Nanofiltration, reverse osmosis

    M. Turan et al., Water Science & Technology, 45(12), 355, 2002
- Fluid abstraction from liquid waste
  - Electrochemical abstraction

    Mini-Waste consortium core project
- Packaging
  - Biodegradable packaging AFM 200

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Information and decision making

- Forecasting and scheduling
  - demand forecasting, production scheduling
  - weather forecasting UK Foresight Programme
  - Integrated supply chain issue
- Production yield analysis
  - Re-evaluate yield, losses, waste, product specification etc.

M.A.J.S. van Boekel, Wageningen University

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Information and decision making

- Sustainability analysis tools applied to decision making about waste management, recycling etc.
  - e.g. utilisation of energy as animal feedstuff versus energy recovery technologies
- Waste “account” information
  - Informed decisions without information on amounts, nature, patterns?
  - Greater and sustained national level investment and co-ordination required.

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