



# Industrial Biotechnology and Innovation - A Croda Perspective

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CRODA



## Croda at a glance

- Established in 1925 - Mr Crowe and Mr Dawe.
- 910m turnover, £106m PBT (2009).
- Core markets - Personal Care, Health Care, Crop Care, Home Care, Polymer Specialities and Lubricants.
- Key customers - P+G, Unilever, Avon, Boots, L'Oreal and Syngenta.
- Global manufacturing base.
- Raw material base is primarily naturally derived.
- Add value to naturally derived raw material base by purification, separation, chemical modification.
- Sell effects and not chemicals.
- Driven by innovation and exploitation of technology.



## What are the key drivers in our core markets?

- Natural
- Renewable
- Sustainability
- “Green”
- Low environmental impact
- Biodegradable
- Performance



Enterprise Technology  
The Science of Innovation

## Innovation you can build on™

- Innovation is the key to Croda's success.
- From an idea to commercial reality.
- This is what Croda aspires to in all functions.
- Very market and customer focused.
- Applying this same standard in Industrial Biotechnology.

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## Industrial biotechnology - why?

- Address key drivers in our core markets.
- Route to unique products not accessible from classical chemical processing.
- Achieve unique effects.
- Further differentiation of the business.
- Route to enhancing company profitability.



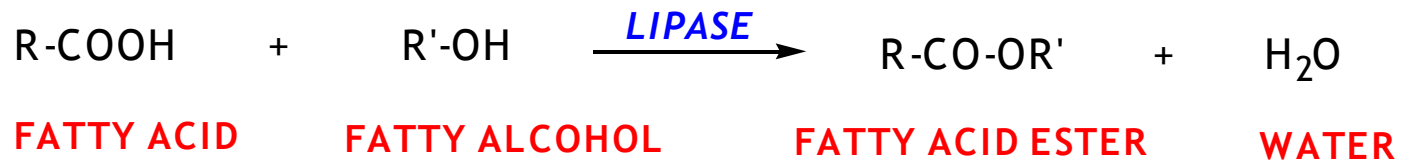
## Industrial biotechnology - not new to Croda.

- 1960's - fermentation of waste starch to lactic acid.
- Over 30 years experience in using proteases, alpha-amylases and beta-glucanases for the manufacture of Croda's speciality proteins.
- More recently the use of lipases for hydrolysis of triglycerides and peroxidases for polymerisation.
- Large-scale dedicated plant to produce fatty bioesters using immobilised esterase beds.

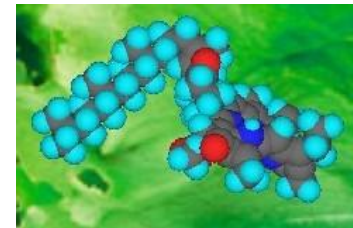


# Examples of industrial biotechnology

- Biocatalysis
- Fatty bioesters.
- Solvent free “green” process.
- Immobilised lipase.



- Batch or ‘Semi-continuous’ fixed bed process
- Mild reaction temperature : ca 55-60°C
- Nearly quantitative conversions
- Enzyme recycling very important



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## Examples of industrial biotechnology

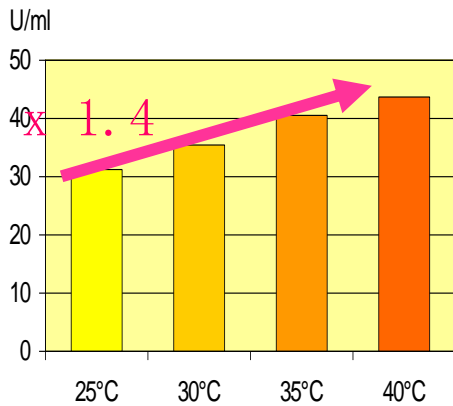
- Venuceane
- Extract of a deep sea microbe
- Enzyme with multi anti-oxidant activity
- Anti-ageing effects for skin care.



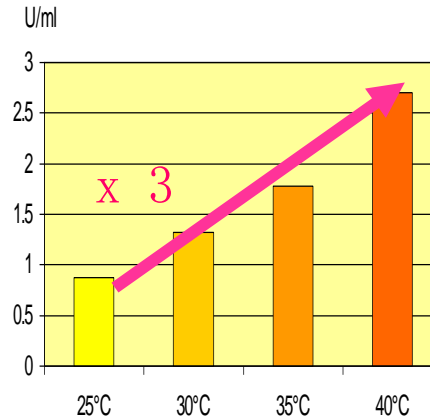


# Venuceane in-vitro studies

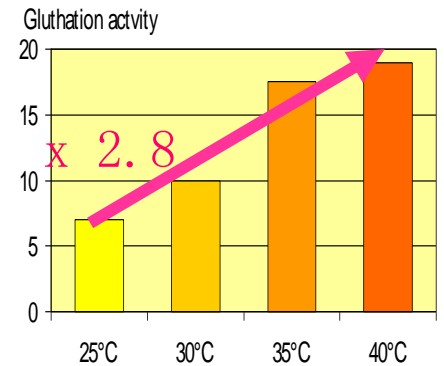
## DETOXIFYING EFFECT VERSUS TEMPERATURE (Venuceane™ 3%)



SUPEROXIDE DISMUTASE  
ACTIVITY



CATALASE-LIKE  
ACTIVITY



GLUTATHION PEROXIDASE  
ACTIVITY

MULTI-ENZYMATIC ACTIVITY similar to the skins natural defences.  
DETOXIFYING ACTIVITY of Venuceane™ proportional to temperature.

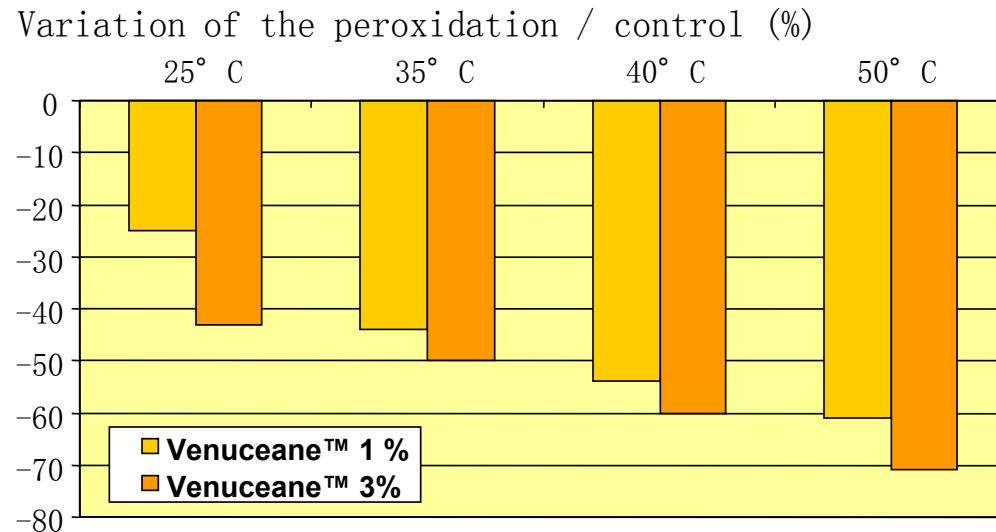


# Venuceane in-vitro studies

## PROTECTION OF THE CELL MEMBRANE (phospholipid)

Model of phospholipid membranes exposed to UVA irradiation of 10 J/cm<sup>2</sup> (equivalent to 1 hour of sun exposure ) and at different temperatures.

Measurement of lipid peroxidation.



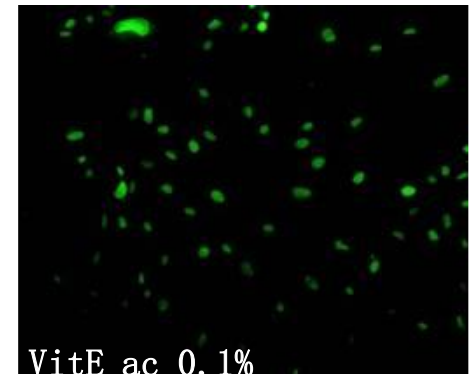
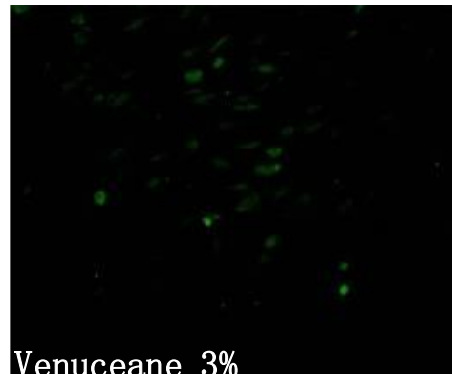
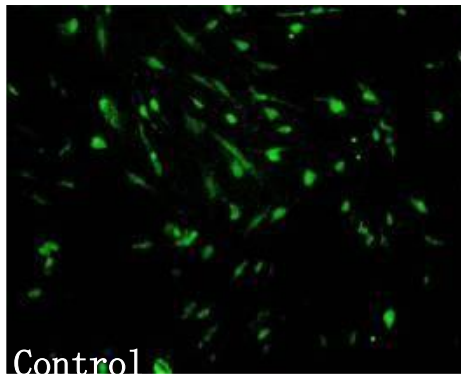
Venuceane™ strongly protects the phospholipids from peroxidation. Protection increases with temperature.



# Venuceane in-vitro studies

## PROTECTION AGAINST DNA OXIDATION

Fluorescent detection of oxidised DNA base Guanine in human fibroblasts, after UVA irradiation of 10 J/cm<sup>2</sup> (equivalent to 1 hour sun exposure), with 3% Venuceane™ or 0.1% Vitamin E ac



Venuceane™ protects DNA from oxidation caused by UVA irradiation better than Vitamin E



# Venuceane in-vivo studies

- Parameters tested
  - Skin hydration TEWL: Tewameter
  - Quality of *Stratum corneum*: stripping and Electron Microscopy
  - Skin appearance, study with VISIA® system:
    - ageing parameters (spots, wrinkles, blemishes)
    - skin age
    - photography
  - Consumer perception of benefits: questionnaire





# Investment in industrial biotechnology

- Widnes site
  - New Biotransformation (fermentation) plant.
  - Industrial Biotechnology history on site.
- Sederma (France)
  - Pilot Fermentation facility
  - Pilot plant cell culture capability.
- Gouda (Netherlands)
  - Bio-esterification facility
- Other sites with industrial biotechnology interest:
  - Leek (Staffordshire)
  - Mevisa (Spain)
  - Campinas (Brazil)



# Investment in industrial biotechnology

- New facility in Widnes, Cheshire.



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The Science of Innovation



# Investment in industrial biotechnology

- Global internal Biotechnology Innovation Group established (UK and France).
- Numerous UK/EU commercial and academic partnerships established.
  - Aquapharm (Oban - Blue Biotechnology)
  - CoEBio<sup>3</sup> (Manchester - White Biotechnology)
  - University of Newcastle (Blue Biotechnology)
  - University of Nottingham (Blue Biotechnology)



## Collaboration with CoEBio<sup>3</sup>

- Studentship (Ph.D)
- Evaluation of bio-catalytic route to fatty amides.
- “Green”.
  - Solvent free
  - Lower temperature.
  - Safer chemicals.



## Conclusion

- Croda believes industrial biotechnology is a key enabling technology providing a route to continued differentiation and profitability.
- Utilising industrial biotechnology will demand a change in the traditional skill base in the speciality chemical industry.
- Application of the technology is limited only by our imagination, not by the technology.

*However good we believe we are as chemists - nature is better!*