Environmental Genetic Engineering by RNAi and Genome Editing

Directions

Photolysomes. The liposome encapsulated DNA repair enzyme, photolyase derived from plankton, is hyper-efficient and unique in its ability to reduce the visible signs of UV-induced insults.

Endosomes. A liposome encapsulated extract from the marine microbe, Micrococcus Lysate. Extremely UV resistant, the extract contains the enzyme UV-endonuclease which improves the appearance of sun damaged skin.

Mitosomes. A liposome encapsulated repair enzyme, Arabidopsis Thaliana, aids in the removal of the signs of oxidative damage.

Ingredients

Clinical Studies

Jack Heinemann
Centre for Integrated Research in Biosafety
School of Biological Sciences
UVB (290-320 nm)

human buttocks

large, recurrent exposures

time post photoreactivation
Based on...

(1) Should dsRNA treatments applied in outdoor environments be regulated?

(2) Environmentally Applied Nucleic Acids and Proteins for Purposes of Engineering Changes to Genes and Other Genetic Material

Article reference: BSHEAL15
Journal: Biosafety and Health
Corresponding author: Jack A. Heinemann
First author: Jack A. Heinemann
Received at Editorial Office: 4 Jul 2019
Article revised: 29 Aug 2019
Article accepted for publication: 18 Sep 2019
Active ingredients

“Delivery of Cas9:sgRNA complexes resulted in genome modification efficiencies as high as 80%” in human cells. Patent No.: US 9,526,784 B2
Penetration technologies

Surfactant drop
hydrophilic (head)
hydrophobic (tail)
solution

Organosilicone

Head
Tail

Surfactant droplets on leaf
Translocation in cell

Crop Protection 127 (2020) 104961
Molecular cargo
Penetrating agents
dsRNA delivery technologies: commercial

BioDirect™ is Based on New Applications of RNAi Technology

BioDirect™ Originated from the Study of Glyphosate Resistance in Weeds

GR-Palmer Uninjured After Treatment With WeatherMAX®

Glyphosate-resistant Palmer Pigweed

GR-Palmer Controlled By Combining WeatherMAX® With EPSPS dsRNA

Pigweed now killed by Roundup

RNA for EPSPS gene degraded
Delivery at industrial scales

laser perforation

organisms per m³ air: 100,000’s

organisms per gram soil: 10,000-830,000 species

New genetic engineering not like old genetic engineering. The key difference:

- old genetic engineering commercialises the **product**
- environmental genetic engineering commercialises the **process**
- exposures **uncontrolled**: contact, inhalation or ingestion exposures in ANY organism and simultaneously in ALL organisms in an environment
- potential repurposing of products
Acknowledgements

Thanks to:

Sophie Walker
Defence Technology Agency New Zealand

Funding for this research
University of Canterbury