DNA conjugation and reversibility on chitosan surfaces

Rubloff Research Group Accomplishments
DNA conjugation and reversibility on chitosan surfaces

Accomplishment

Single string DNA (ssDNA, probe) was conjugated to chitosan surface via glutaraldehyde activation
Target ssDNA was hybridized to matching probe ssDNA via self-assembly
Reversible DNA hybridization was achieved under urea denaturation and hybridization

Significance

The chitosan-based DNA hybridization is simple to achieve spatially selective assembly
The probe is sensitive and is applied to sandwich assay of total RNA sample
The probe is robust and provides reproducible measurements with a high signal-to-noise ratio seven after repeated hybridization and denaturation cycles

People involved

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Collaborations with Li-Qun Wu, Reza Ghodssi,

Links

Chitosan Electrodeposition

Unusual polysaccharide

Low pH, soluble

High pH, insoluble

Chitosan electrodeposition

High pH region at negative electrode due to hydrogen evolution

Chitosan molecules deprotonated, immobilized at electrode surface
DNA Hybridization on Chitosan

Activated Surface

Probe ssDNA

Target ssDNA

DNA Hybridization on Chitosan
Reversible DNA Hybridization on Chitosan

- The "Chip"
- Chip with Tempered Chitosan
- Glutaraldehyde Solution
- Activation of Chitosan

Electrochemical Deposition of Chitosan

- Coupling of ssDNA
- Chip with assembled ssDNA onto Chitosan

- Urea Solution
- Denaturation

- Probe ssDNA (H₂N\text{\ldots}F)
- Chip with Probe ssDNA

- Generation of Probe Surface

- Target DNA (\ldots F)

- Hybridization
Reversible DNA Hybridization

Analysis of Purified Total RNA from *Escherichia coli* culture by Sandwich Assay


ssDNA (sandwich probe) → Hybridization → mRNA (analyte) → Hybridization

Electrode ← Chitosan ← Glutaraldehyde ← ssDNA (probe)
Virus Assembly on Chitosan


Fig. 2. Schematic diagram of patterned TMV assembly onto ssDNA surface via hybridization onto ssDNA-chitosan surface.