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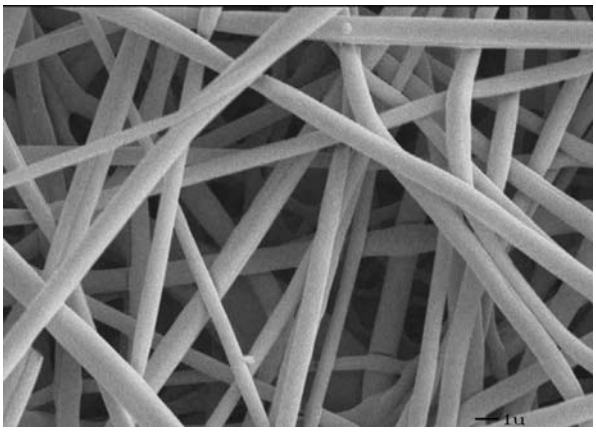
Challenges for Today. Solutions for Tomorrow.

Improved Isolation and Utilization of Zein



Zein electrospun from acetic acid solution – 2000x, 0.4 – 1.6 μm.

What is this technology?

- Improved methods for removing zein from corn gluten meal.
- Zein fibers produced using electrospinning techniques.
- Solvent resistant zein articles.

Improved methods of zein isolation needed

1) Current zein sale price is well over $10/lb due to current isolation procedures and lack of significant market.
2) Use of acetic acid to remove zein from corn gluten meal (CGM) has been demonstrated to be much more effective than alcohol or alcohol/water systems.
3) Zein from CGM is of quality to provide films and electrospun fibers; higher amount of oil gives lower protein content of recovered zein.

Zein fibers have been produced using electrospinning technique

1) Electrospinning, a type of dry spinning, uses a high voltage to produce zein fibers from zein solutions.
2) Zein fibers can be obtained from alcohol/water or acetic acid solutions.
    - Alcohol water solutions give ribbon fibers; acetic acid gives mainly round fibers.
3) Spinning conditions can impact fiber diameter and spinning continuity.

Zein fibers with improved solvent resistance obtained through cross-linking with glutaraldehyde (GDA)

1) Reaction of zein with GDA in acetic acid has been shown by other researchers to provide improved articles.
2) The zein/GDA-acetic acid solution, after sufficient reaction time, can be electrospun giving ribbon fibers with increased diameter relative to control.
    - With increasing GDA, solution concentration had to be reduced to give quality spinning and lower diameter fibers.
3) To obtain solvent resistance, the fibers had to be heated.
    - Higher levels of GDA required less time and/or reduced temperature to deliver improved resistance.
4) Without GDA modification, exposure of zein fibers to a drop of water would result in film formation. With GDA modification and thermal treatment, water does not affect the fibers.

Solvent resistant zein articles

1) Through reaction of zein with glyoxal in solution or melt state, zein articles can be produced that are resistant to dissolution by a variety of solvents.
2) Solution produced articles have improved physical properties relative to melt produced articles.

Moving Forward

1) Elimination of additional heating to impart solvent resistance.
2) Improved melt processability of zein articles.

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