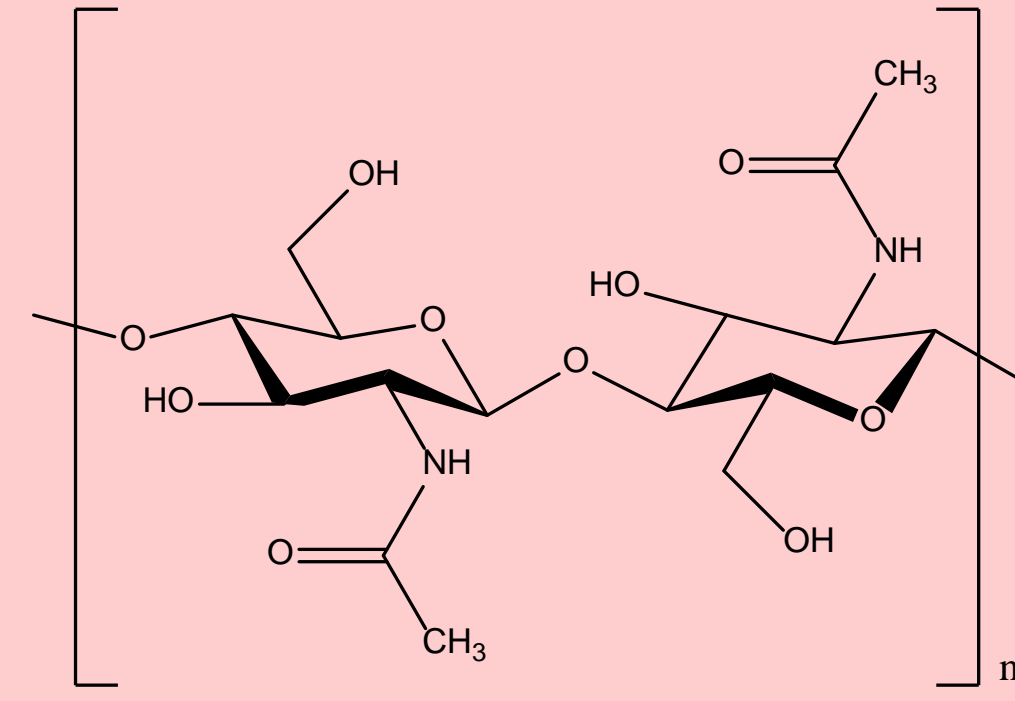


## Introduction

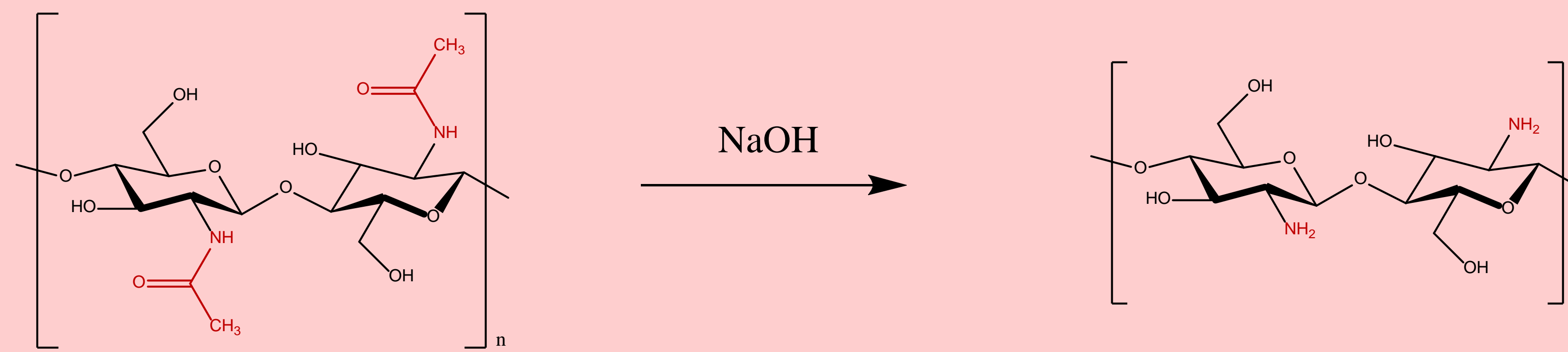
Chitin is an extremely abundant natural with many amazing properties.



Chitin is already used in the agriculture, medical, cosmetic and water treatment industries.<sup>1</sup> In the field of biomedicine, chitin has been found to be able to clot blood and heal wounds faster, and it is non-toxic.<sup>2</sup> Even though it is used commercially in a wide range of applications, most of the commercial supply of chitin comes from one source, shrimp shells. Different sources such as crawfish and insects have large quantities of chitin but the difference between the sources is not well understood.<sup>3</sup>

## Deacetylation Process

- Chitin is a mechanically strong material due to the high degree of hydrogen bonding however, this means it is also insoluble in common solvents.
- Deacetylation improves solubility but decreases the mechanical properties.



Chitin

Chitosan

- By controlling the degree of acetylation, it should be possible to make it soluble without sacrificing all of the mechanical strength.

## Sources of Chitin and the Extraction Process



LA Crawfish production was 81.9 million lbs in 2005. The shells are discarded as waste.

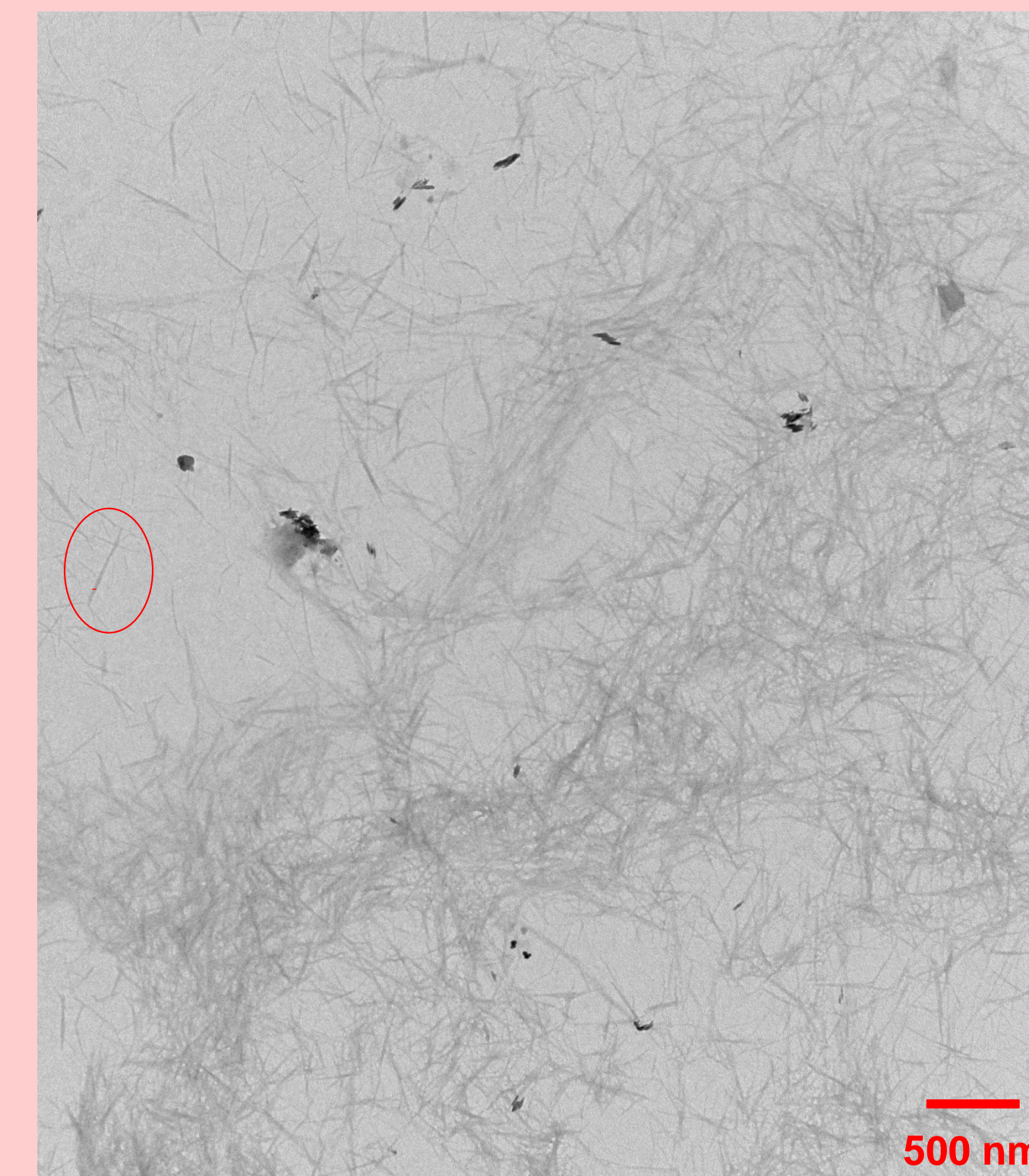
Almost 69 thousand lbs of lobster were caught in Maine in 2005.

As many as 1 billion cicadas can be found per square mile every 17 years

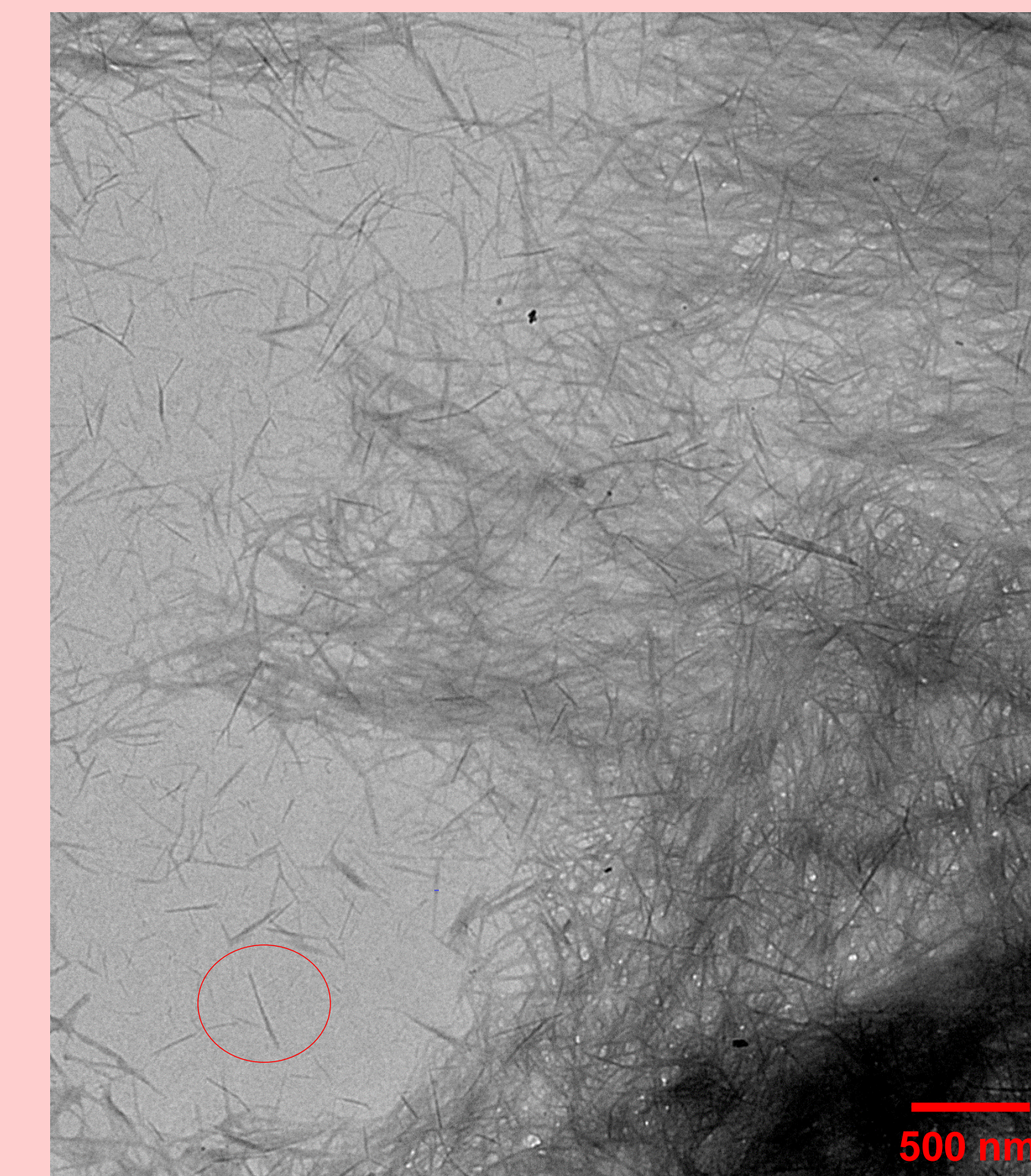
- Source material, washed and ground
- Three separate agitate/drain/wash cycles
  - 100°C in NaOH
  - Room temperature in HCl
  - Room temperature in bleach
- Desiccate for 48 hours
- Weigh final product
- Characterize



## Results – TEM (Cicada)



The fiber circled above is about 460 nm long and 23 nm wide.



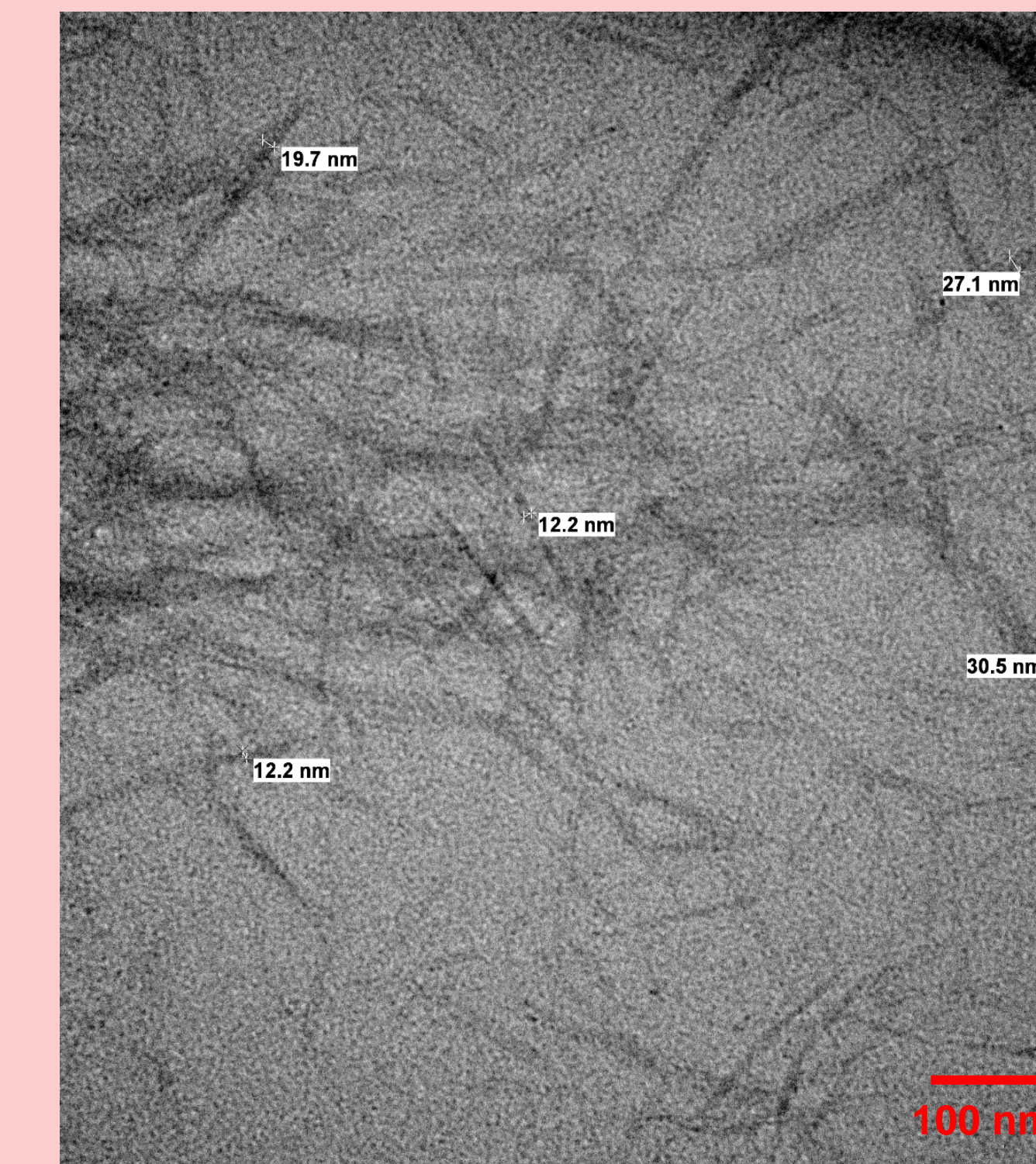
The fiber circled above is about 340 nm long and 24 nm wide.

## Results – Aspect Ratio

- The aspect ratio is a measure of how long and skinny a fiber is.

$$\text{Aspect Ratio} = \frac{\text{length}}{\text{width}}$$

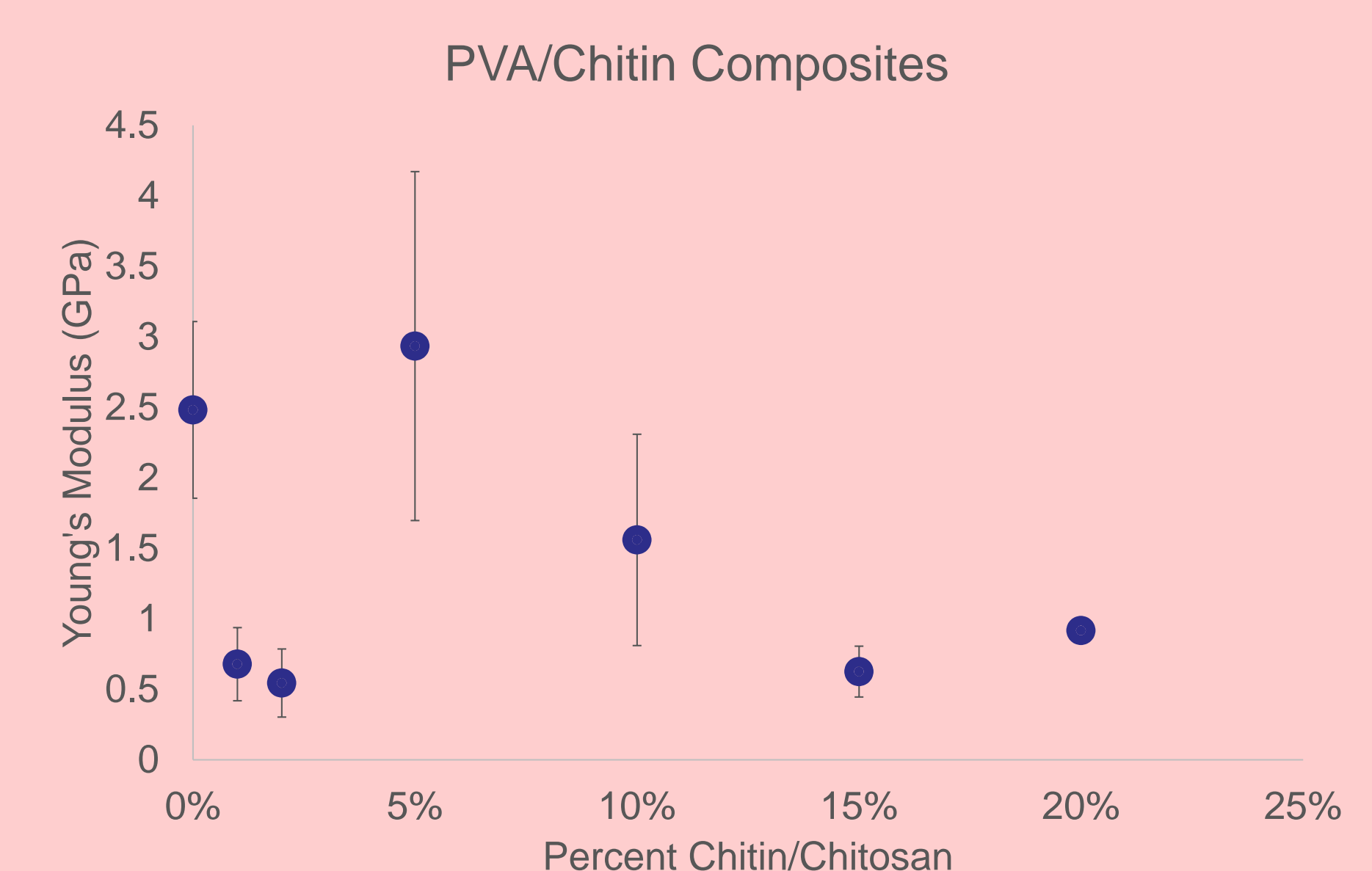
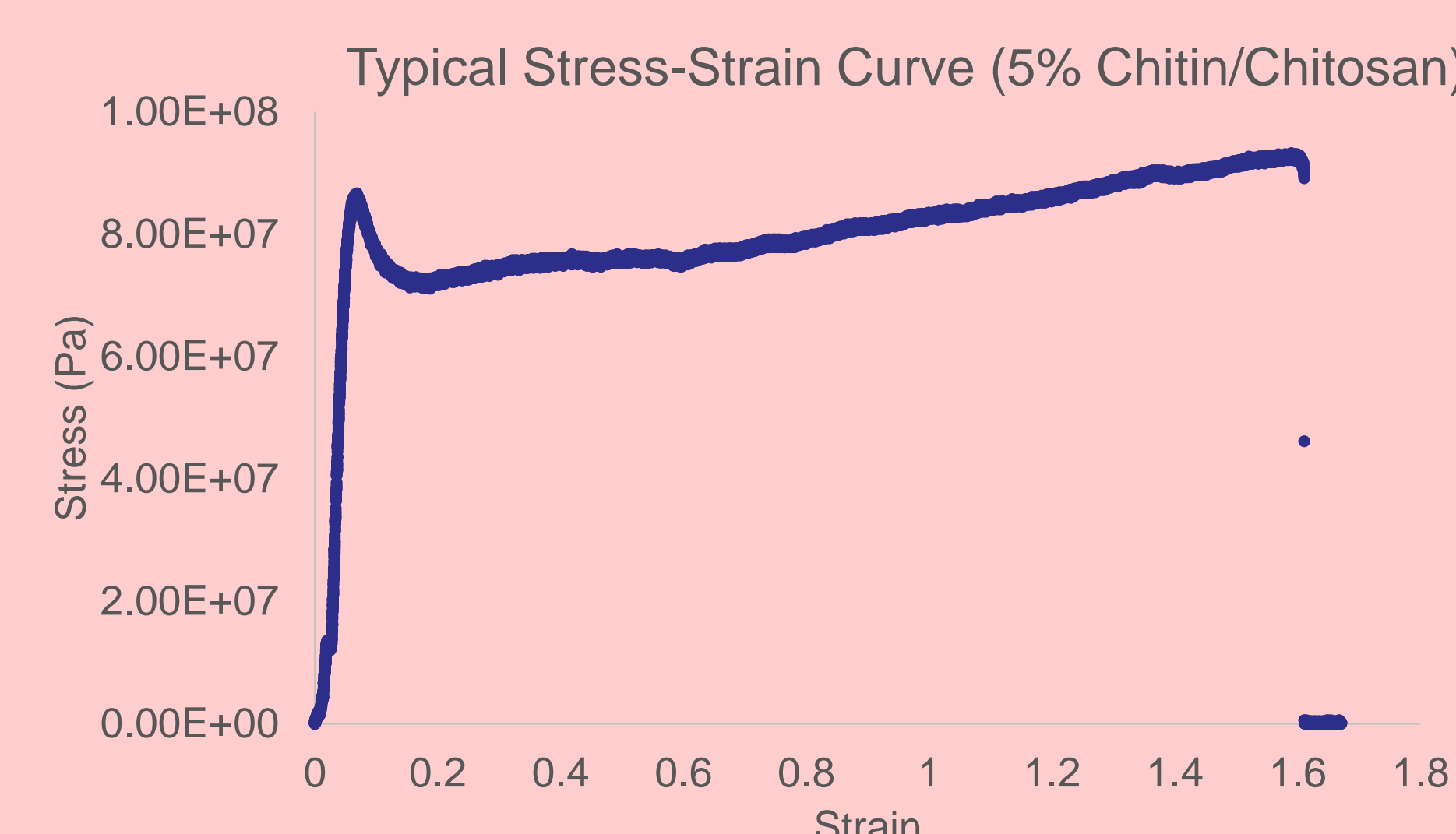
- For example; a circle would have an aspect ratio of 1.
- The chitin fibers in the cicada sample have an average aspect ratio of 31.7 +/- 8.1.
- The higher the aspect ratio, the lower concentration needed for percolation.



Cicada – the numbers above show the widths of the fibers

## Results – Mechanical Testing

- Chitin/chitosan fibers were combined with poly(vinyl alcohol) (PVA), a common plastic
- By adding a mechanically strong filler, the goal was to increase the mechanical properties of the composite<sup>4,5</sup>
- The top figure is a typical stress-strain curve for one of the composites
- The sample was pulled until it broke and the force was measured
- Most samples did not show an increase in Young's Modulus expect at 5% loading
- Large error means the results are inconclusive

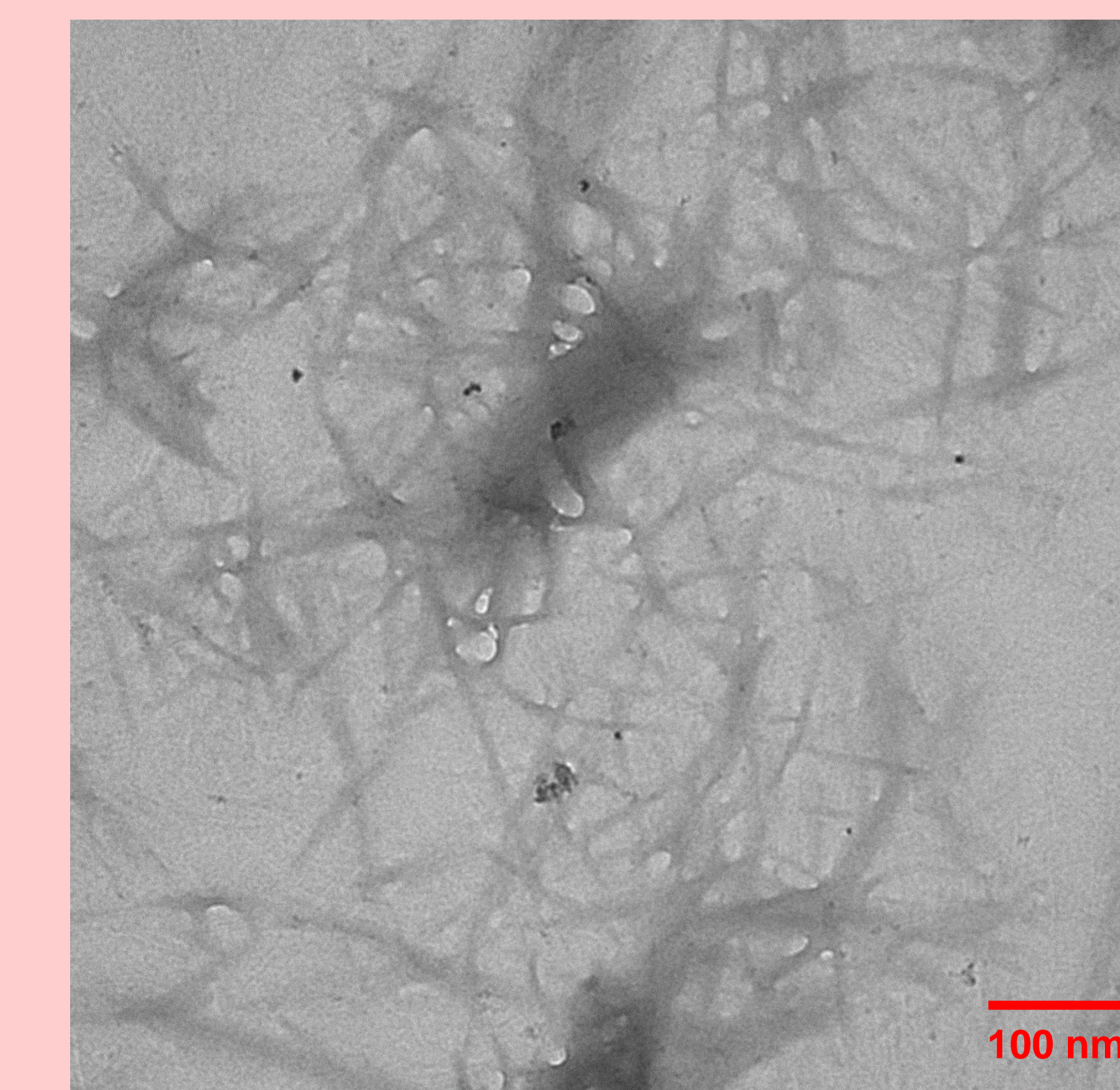


## Conclusions

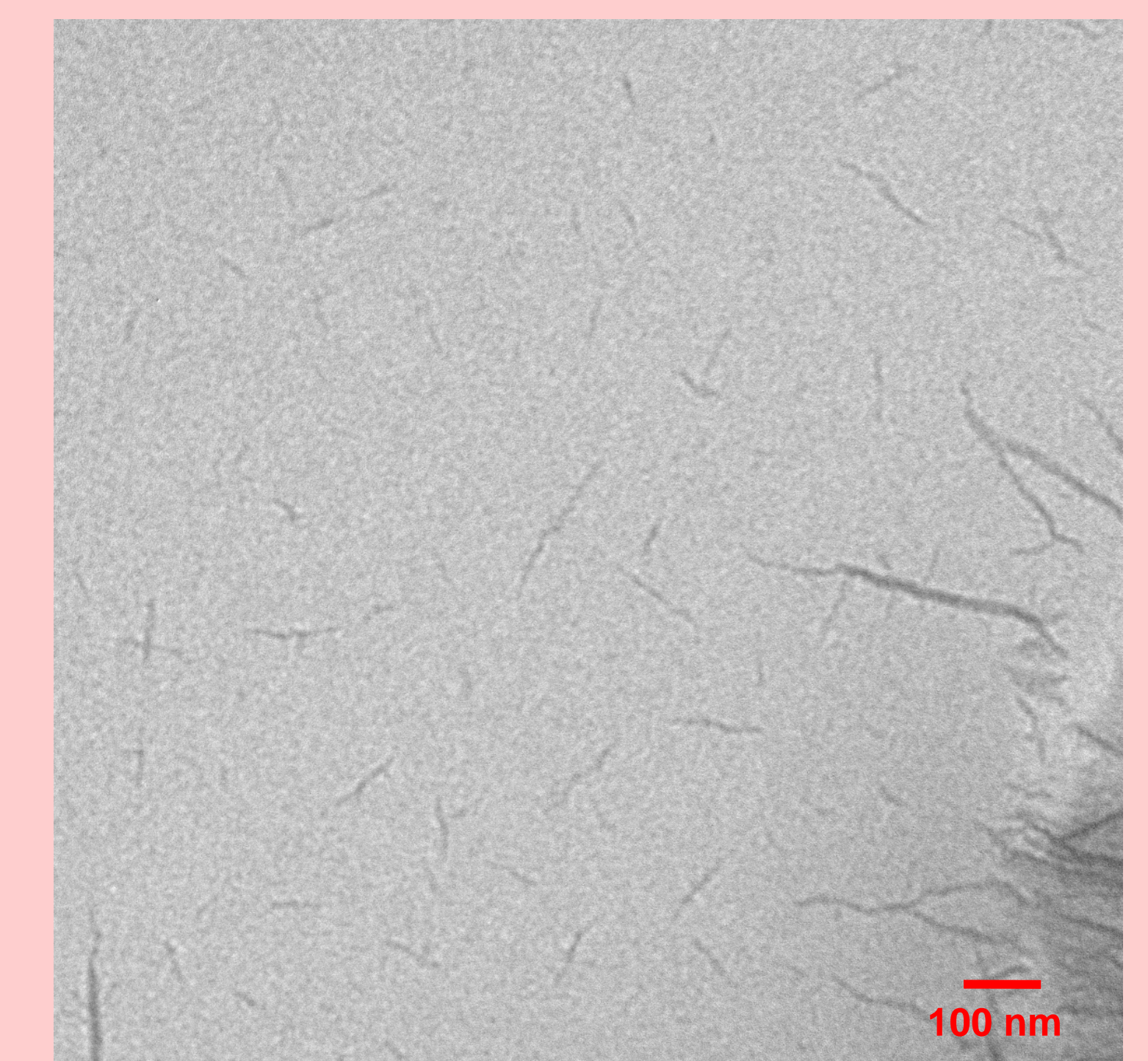
- There does seem to be some differences in the fiber size and shape of the different source materials. However, more TEM scans are needed of the crawfish, lobster, and shrimp to confirm this.
- The mechanical testing suggests that the chitin could potentially strengthen PVA composites but too much can have a detrimental effect.

## Future Work

- Preliminary tests show that the source material has a significant impact on the chitin fiber aspect ratio; mechanical testing needs to be done to see if this difference affects composite formation
- The ratio in chitin to chitosan samples needs to be varied to determine how this change will affect solubility and fiber formation



Lobster



Shrimp

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