

Effect of addition of amino acids on Tellurium wires

Dr. Perumal Ramasamy

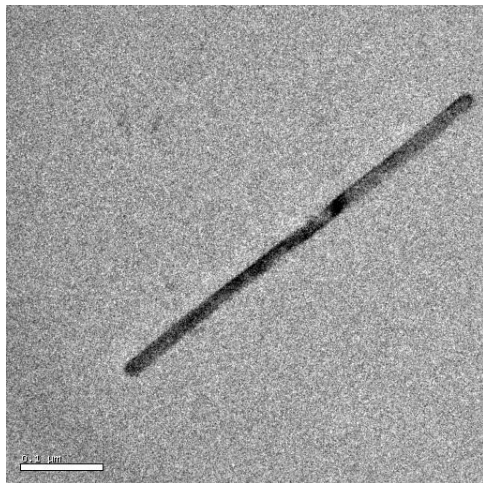
Samal

T.S.Sreeprasad

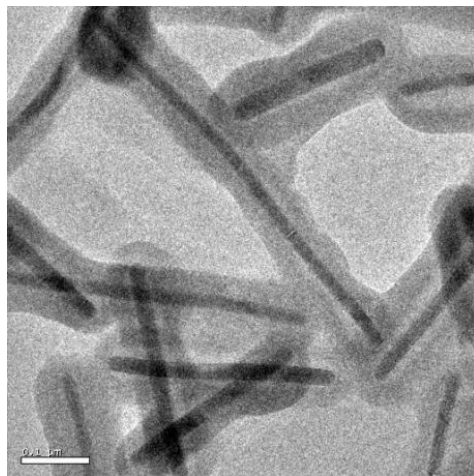
Sajan

Background

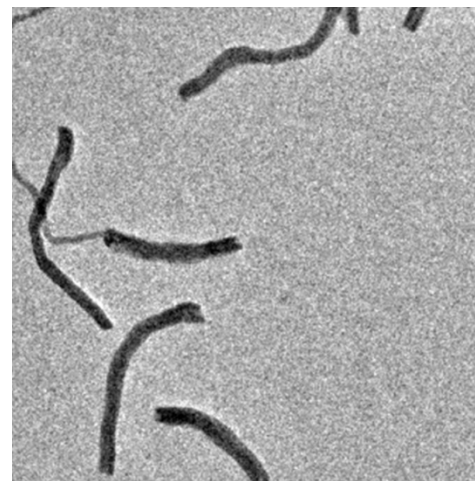
Bending and Shell Formation of Tellurium Nanowires Induced by Thiols – T.S.Sreeprasad and Prof. T. Pradeep



Tellurium rods



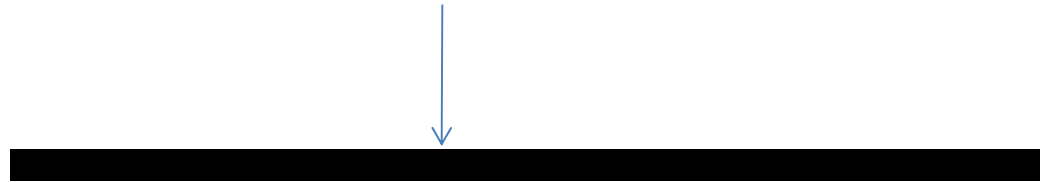
DMSA + Tellurium rods having SDS



DMSA + Tellurium rods having little SDS

The transition from p-bonding valence band (VB2) to the p-antibonding conduction band (CB1) is known to show a characteristic feature around 280-300 nm, known generally as peak I. The second feature referred to as peak II is due to the transition from the p-lone pair valence band (VB3) to the p-antibonding conduction band (CB1), which comes around 650-750 nm. As length of the NW increases, peak II will shift to a higher wavelength region.

Amino acids will have a greater effect on the width



The peak at ~ 270 nm is an indicator of the width of the bare Tellurium rod

The peak at ~ 700 nm is an indicator of the length of the rod

The changes in the spectra may be more sensitive at ~ 270 nm.

Also for the changes to be observed, Amino acids may have to be included at the very early stages of formation of Tellurium rods. Preferably at time = 0 and the evolution of the spectra has to be observed.

Procedure

Amino acids are added to Tellurium rods as they are forming (2min stirring of Tellurium dioxide and hydrazine hydrate).

16 mg Tellurium dioxide was added to 10 ml of hydrazine hydrate. This was stirred for 2 min using magnetic bead. Then equal amounts (2 ml) of the solution were added to separate tubes having 21 mg serine, 34.8 mg Arginine, 29.4 mg glutamic acid and 48 mg cystine.

The final concentration in the tubes is 10mM Tel and 100 mM amino acid.

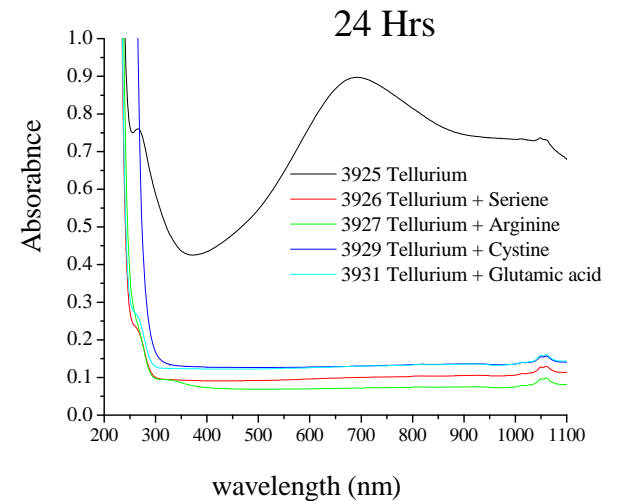
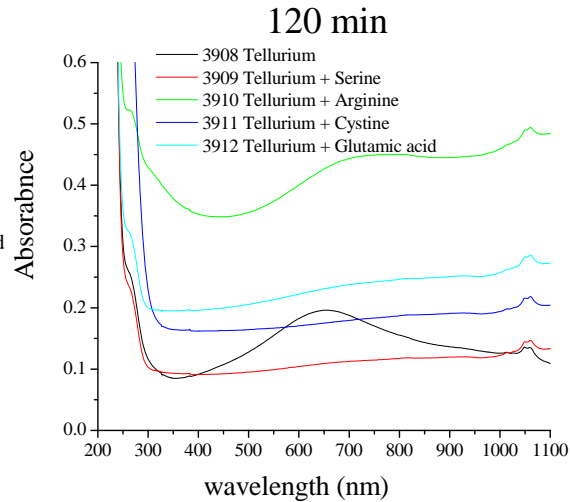
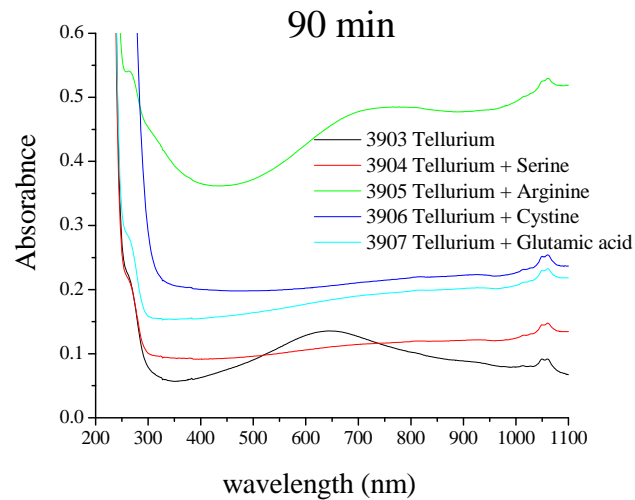
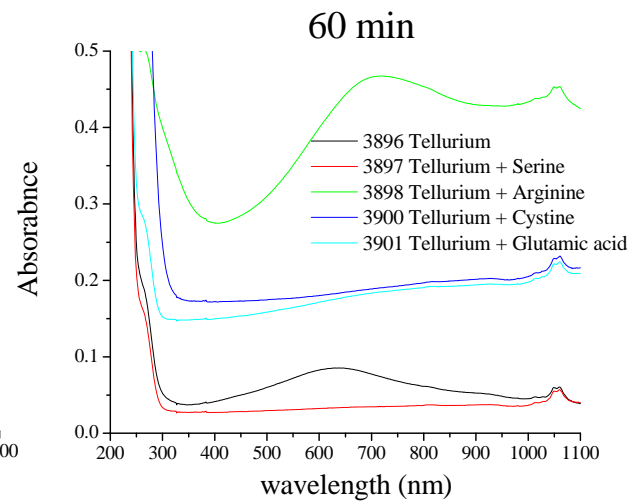
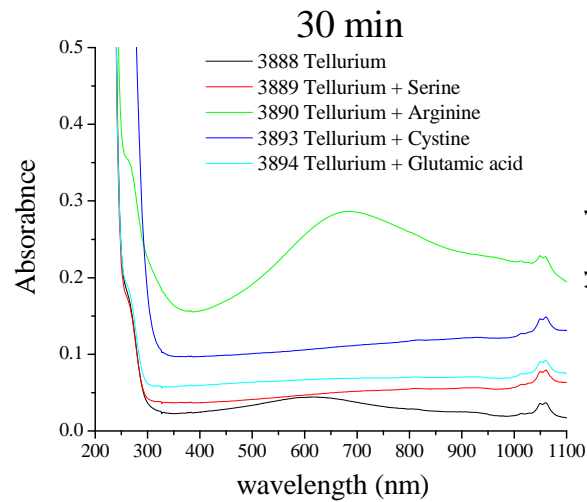
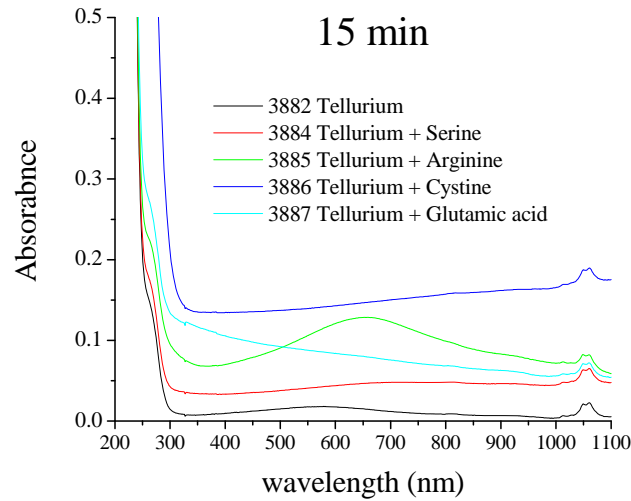
UV vis data was collected for the following samples

- Tel both parent and centrifuged
- Tel + Amino acids as a function of time (every 30 min)
- Tel + Amino acids incubated for overnight
- Tel + Amino acids incubated for overnight and the centrifuged

The centrifuging was performed 2 times

SEM images were obtained for Tel + Amino acids incubated for overnight and the centrifuged twice.

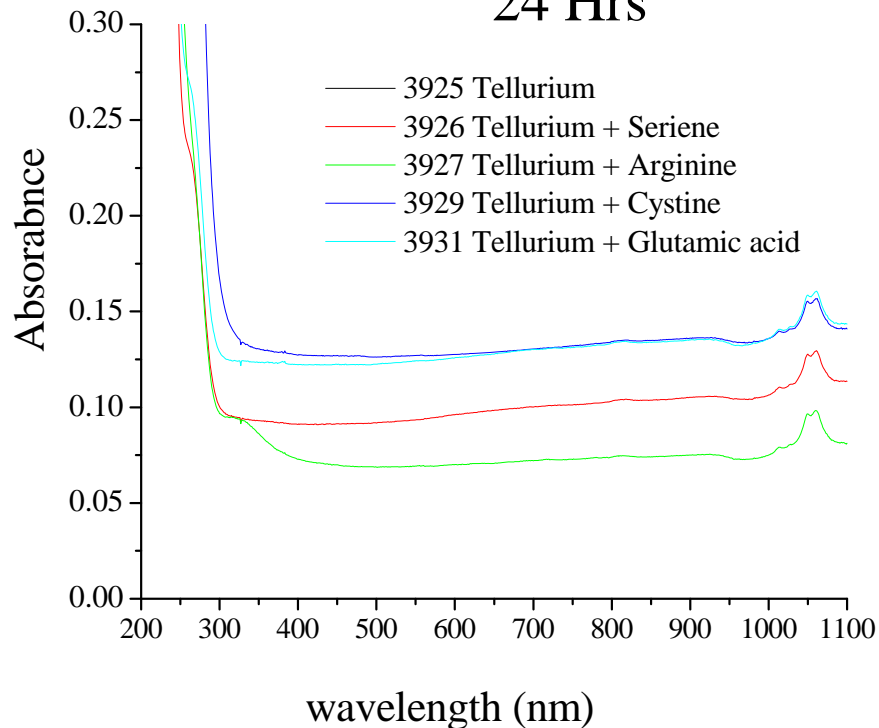
UV spectra with respect to time



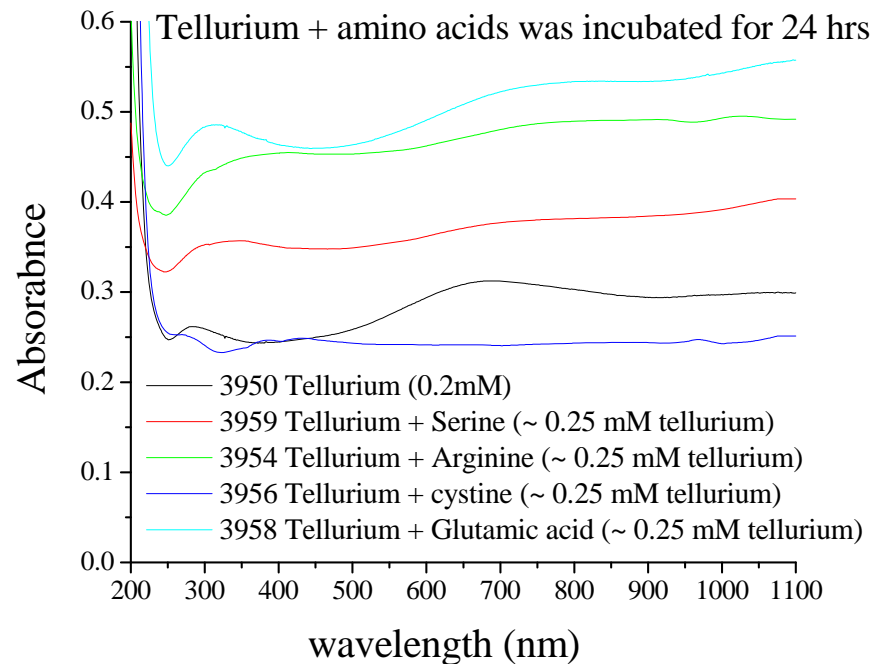
Changes in the spectra happens quickly

Aggregation is more when amino acids are added

24 Hrs



After centrifuging twice

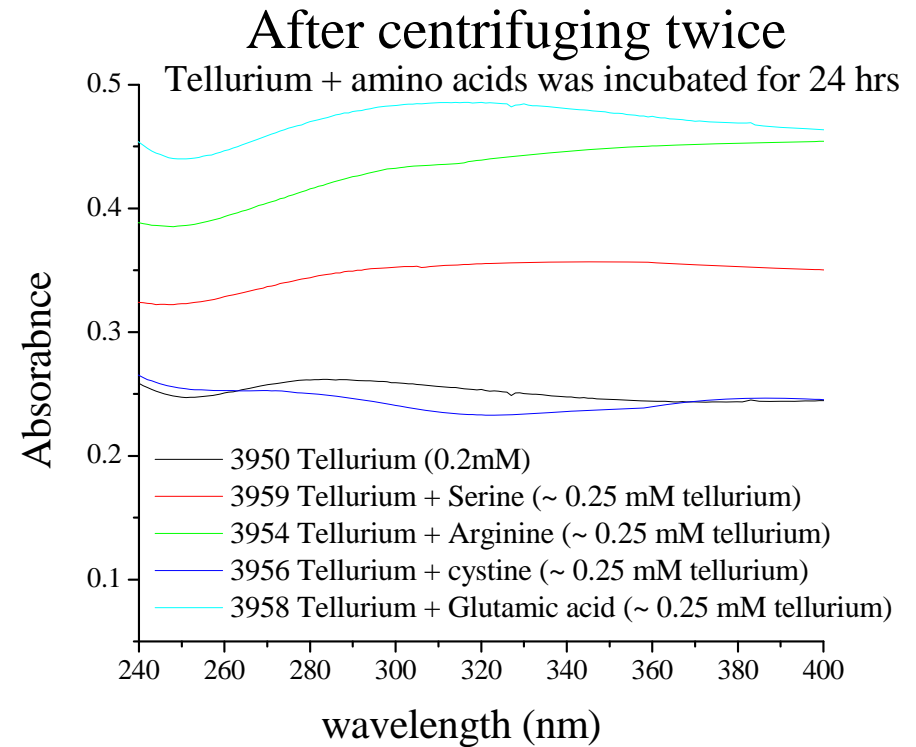
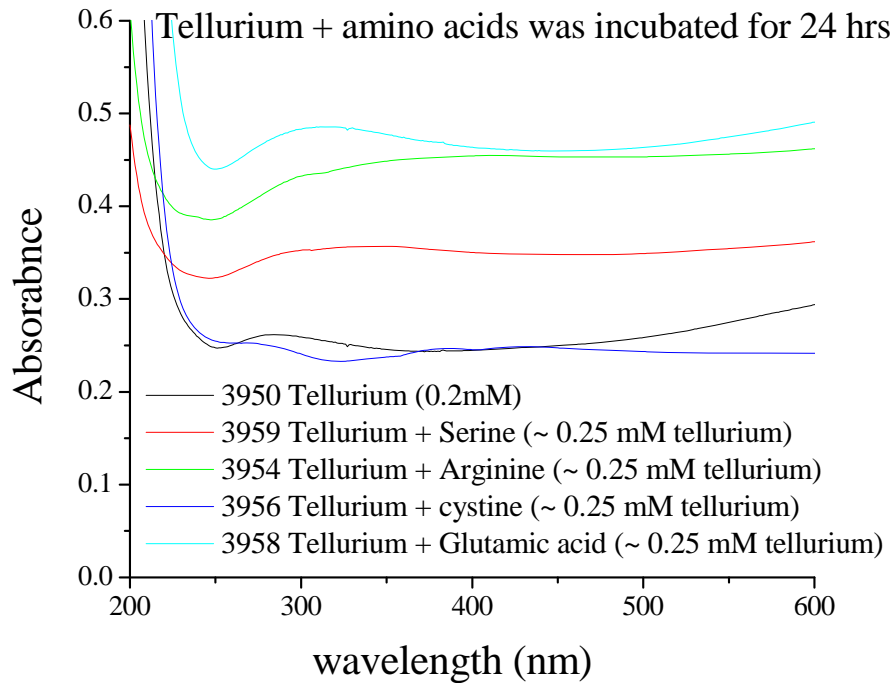


Peak II is broadened and shifted to higher wavelengths for Tellurium + Serine /Arginine / Glutamic acid

The peak after 1000 - 1100 nm is absent after centrifuging the samples

The peak after 1000 - 1100 nm can possibly come from unreacted Tellurium

After centrifuging twice



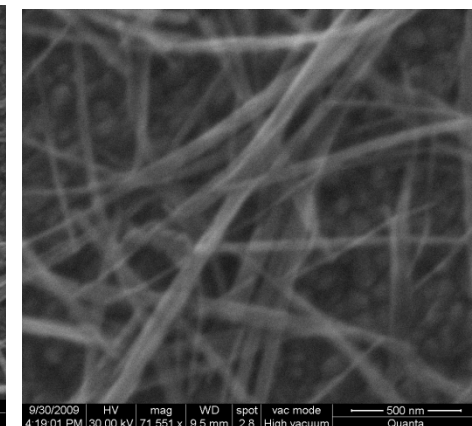
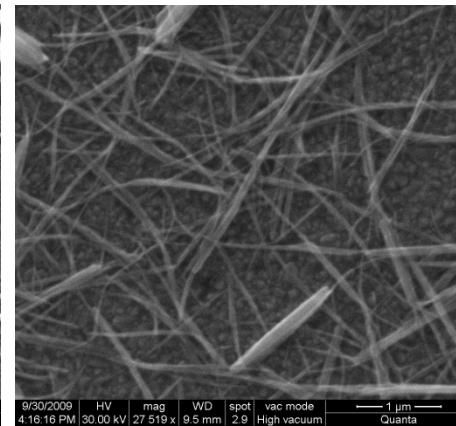
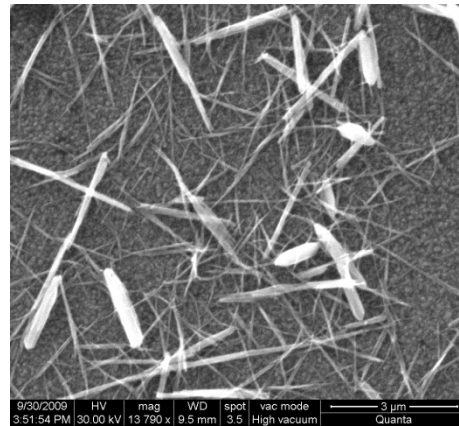
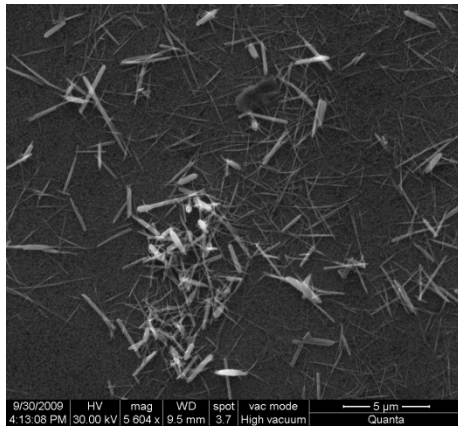
Tellurium centrifuged twice has peak at ~ 290 nm

(Tellurium during growth + Cystine) incubated for 24 hrs , then centrifuged twice has peak at ~ 270-280 nm

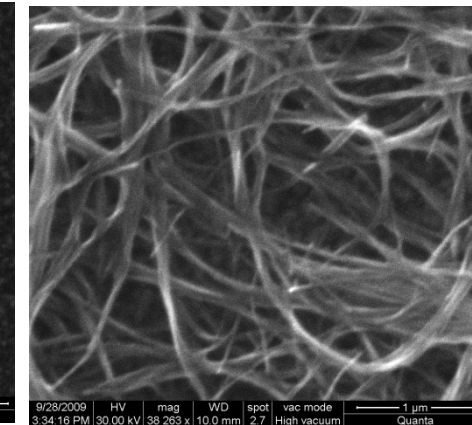
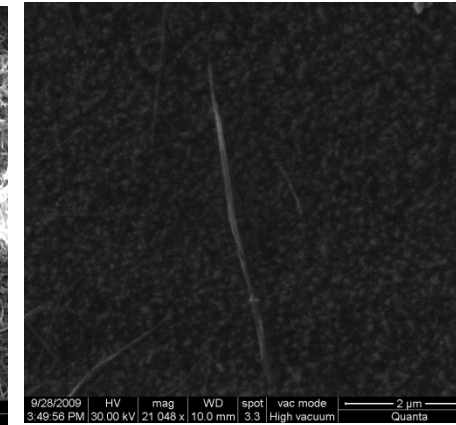
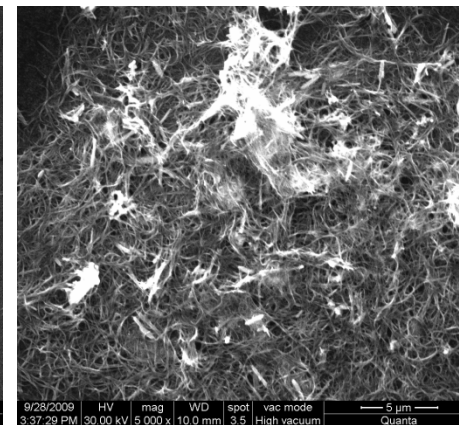
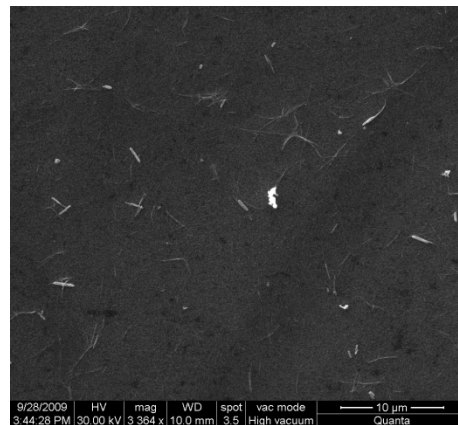
(Tellurium during growth+ Serine /Arginine / Glutamic acid) incubated for 24 hrs , then centrifuged twice have peaks > 300 nm

SEM images

Tellurium not centrifuged – 24 hrs

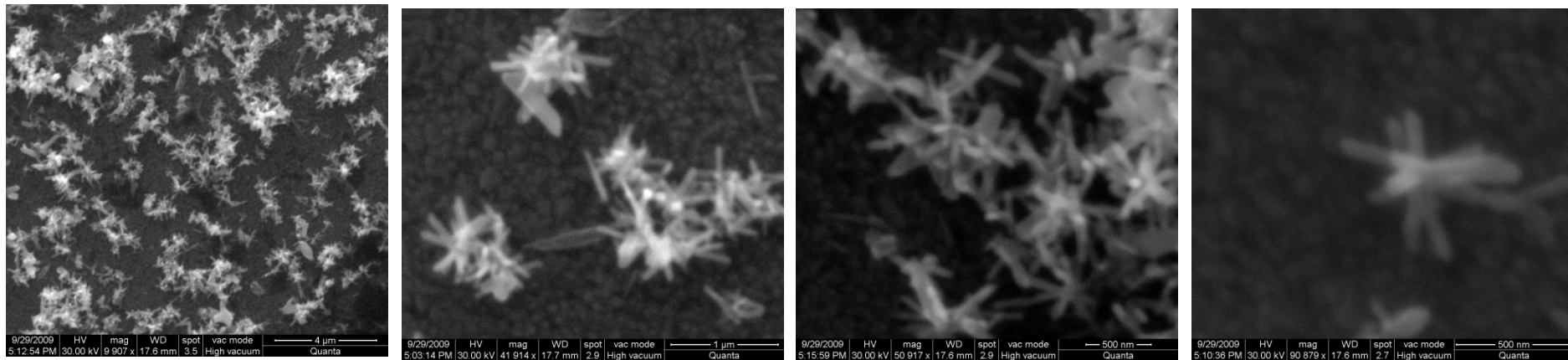


Tellurium centrifuged – 24 hrs



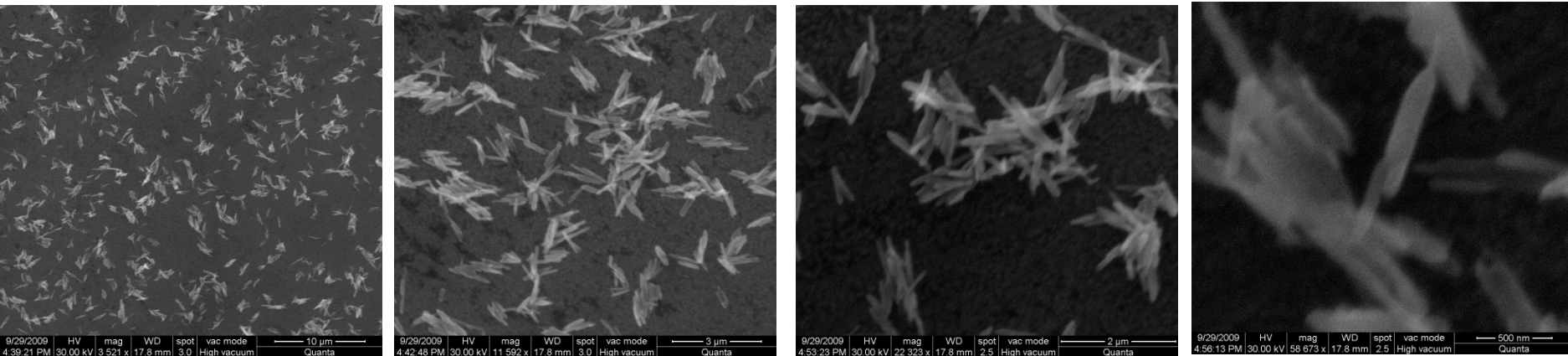
Centrifuged Tellurium rods are more homogeneous. This could be the reason why not centrifuged tellurium rods have peak at ~ 270 nm while centrifuged rods have peak at ~ 290 nm. Also the peak at 1000 nm is absent in centrifuged Tellurium suggesting greater homogeneity.

(Tellurium during growth+ Serine)incubated for 24 hrs , then centrifuged twice



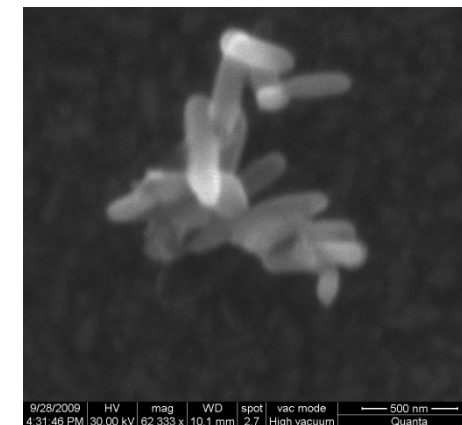
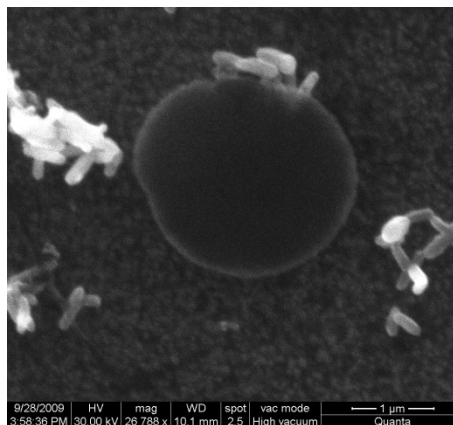
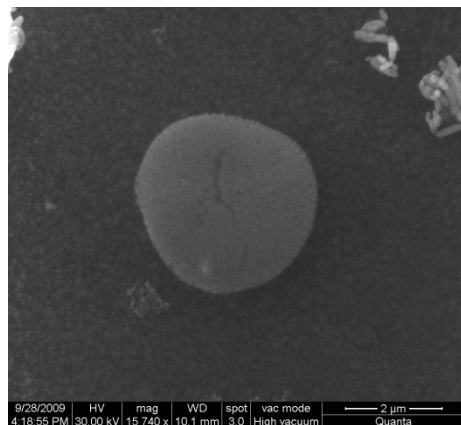
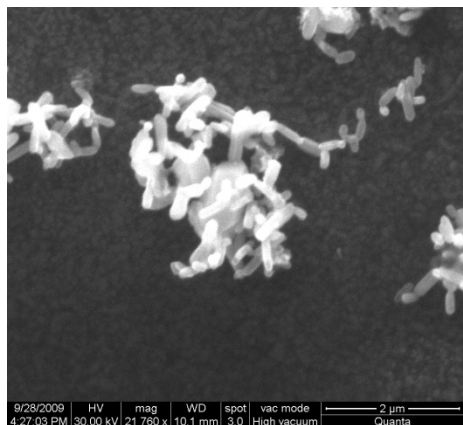
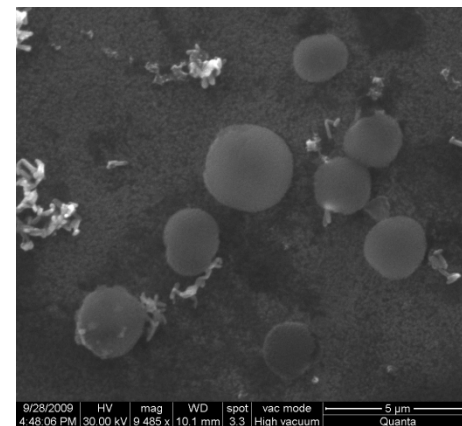
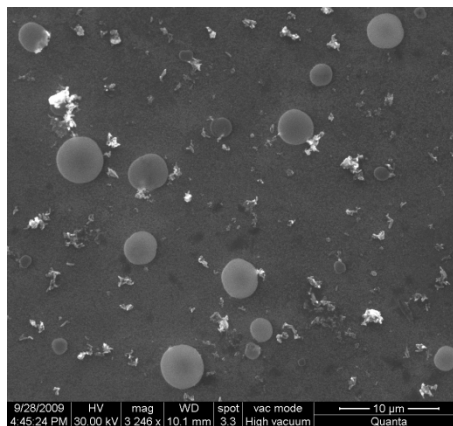
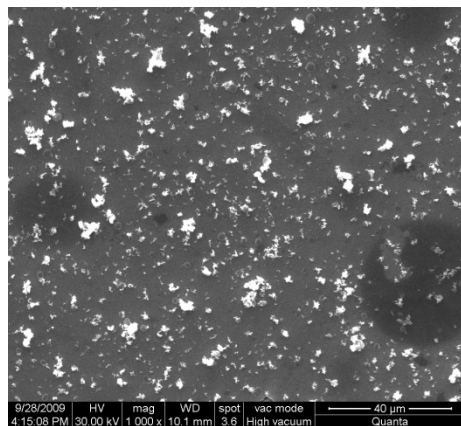
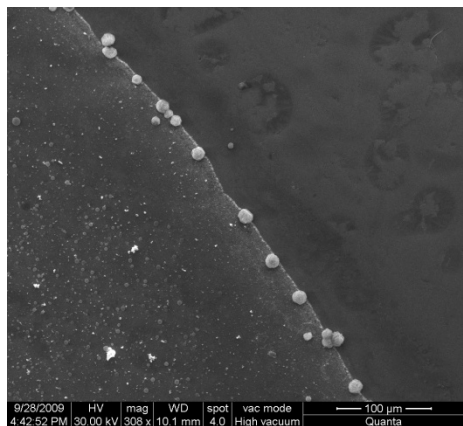
Diameter ~ 70 nm and length ~ 600 nm

(Tellurium during growth+ Arginine)incubated for 24 hrs , then centrifuged twice



Diameter ~ 175 nm and length ~ 1 µm

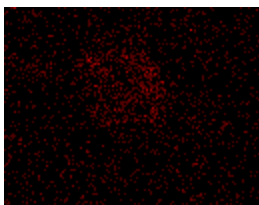
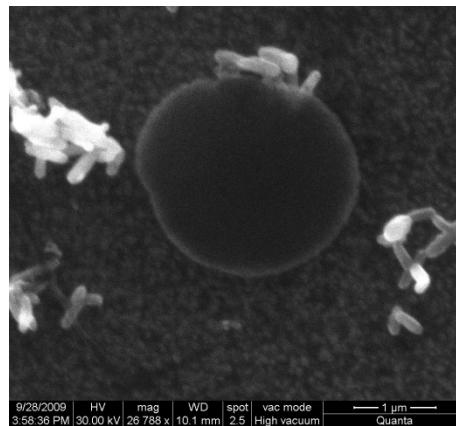
(Tellurium during growth+ Cystine)incubated for 24 hrs , then centrifuged twice



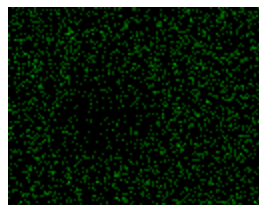
Discs and rods are observed

Diameter of rods is ~ 120 nm and length is $\sim 350 - 400$ nm

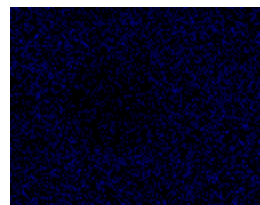
EDAX of discs



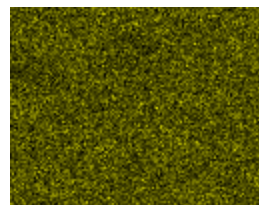
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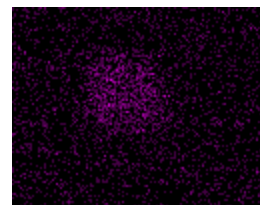
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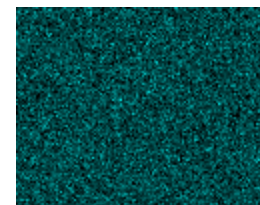
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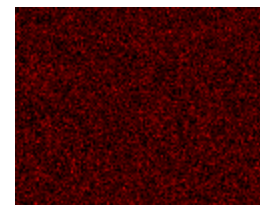
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S



Sn

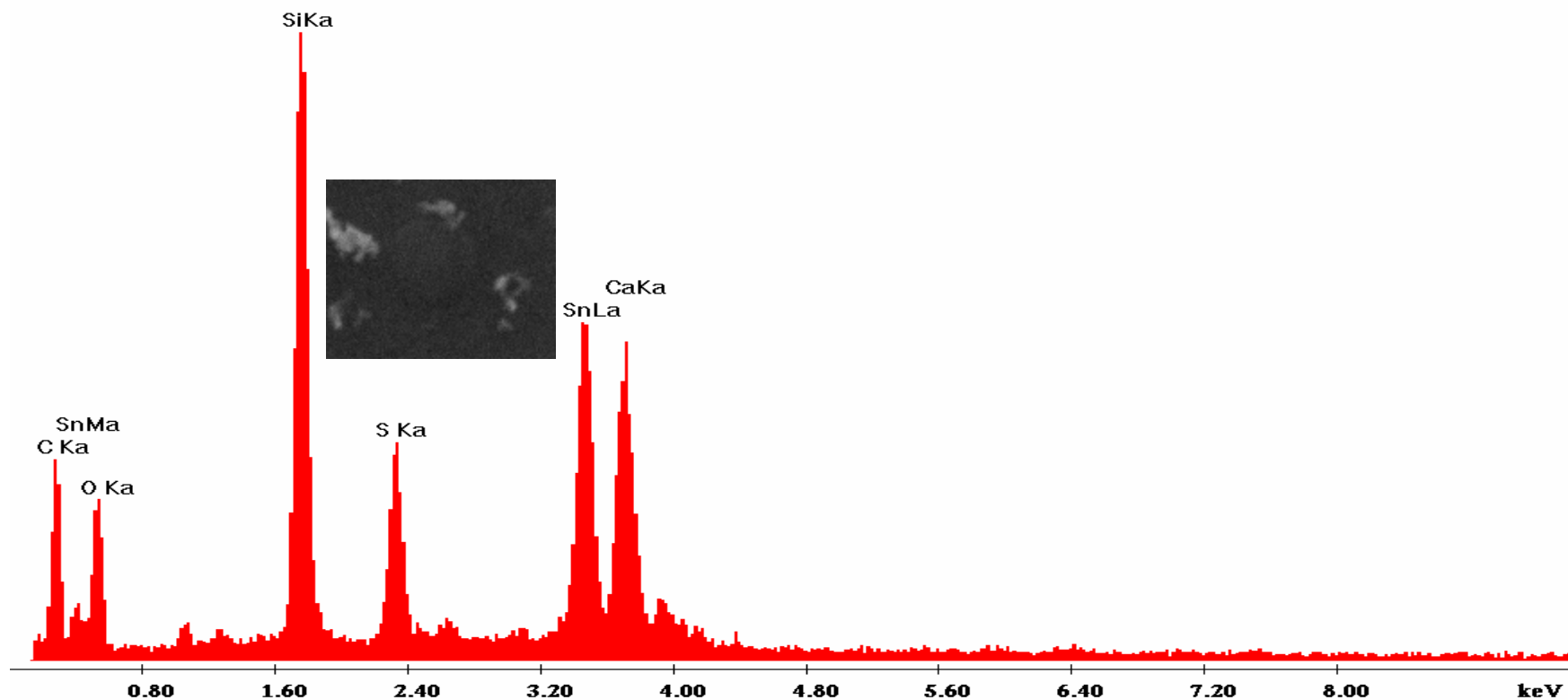


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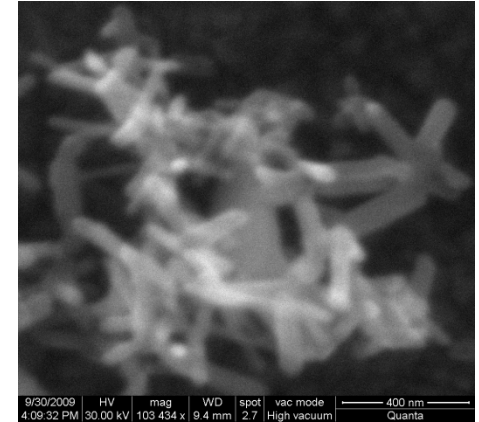
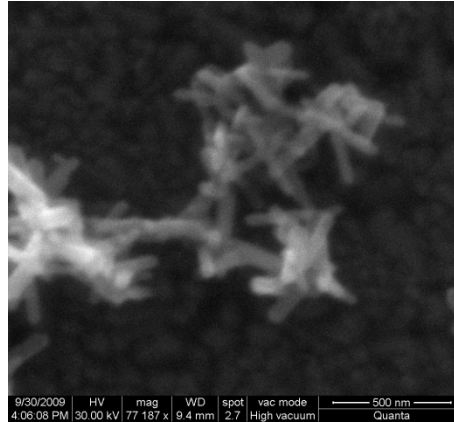
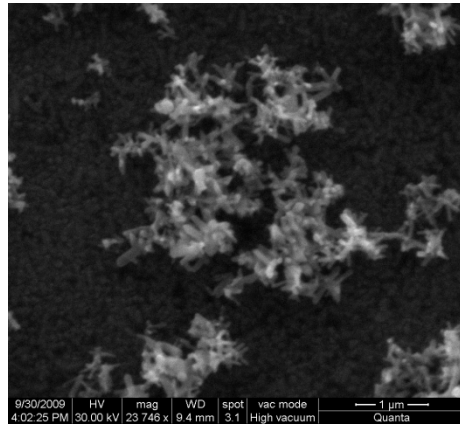
EDAX spectra of the discs shows that it is made of cystine

D:\Prof. T. Pradeep\Sajan\2009\Sept\28-09-09\Perumal\Te + Cystine\2.spc

Label A:



(Tellurium during growth+ glutamic acid) incubated for 24 hrs , then centrifuged twice



Bundled rods of length ~ 330 nm and diameter $\sim 50 - 60$ nm

conclusions

Changes in the UV Vis spectra happens quickly.

Positions of the peaks I (~ 290 nm) and peak II (720 nm) are shifted by inclusion of amino acids to tellurium rods during their formation.

Centrifuging the samples and incorporation of amino acids can possibly lead to more homogeneous tellurium rods.

SEM images show that the morphologies of the growing Tellurium rods are highly modified by cystine and other amino acids