Specification of Nano Silver Colloid

- **Company name**: BinhLan EnviBioChem Company Ltd., Technology Business Incubation Center, University of Technology, Vietnam National University, 268 Ly Thuong Kiet, P.14, Q.10, HCMC.
- **Appearance**: yellow-brown viscous non-transparence liquid, with yellow color on a container wall in shaking. Diluted solution is shine yellow (Fig. 1).
- **Composition:** Silver metallic nanoparticles, trace of $AgNO_3$, Chitosan-dextrin acetate as stabilizer.
- **Dispersion medium**: water.
- **Total Silver:** 500 ppm.
- **Size of Silver nanoparticles** : 5 – 7 nm (Fig. 2).
- **Maximum of surface plasmon spectrum:** 410 – 420 nm (Fig. 3).
- **Maximum absorbance:** not less than 0,90 for 50-fold diluted solution (10 ppm).
- **Number of particle**: not less than $5{,}06.10^{14}$/ml.
- **pH**: 5,0 – 6,5.
- **Storage**: 2 years at room temperature, avoid direct sunlight.

Distinguishing Nano Silver and Silver Salt

- **Nano Silver particles scatter light, so laser beam is clearly seen when directed to dilute nano Silver solution (Fig.4), while concentrated solution of 200 ppm or higher completely reflex laser beam.**
- **The diluted Nano Silver solution is yellow liquid. Colorless liquid is not nano Silver colloid (Fig. 5).**
- **Addition of table salt, soda or alkaline to Silver salt solution forms white precipitation that darkens under sunlight and makes solution to be opaque. Nano Silver Solution does not show such change. (Fig. 5)**
- **Nano Silver (2 – 30 nm particle size) is characterized by the suface plasmon spectrum at 410 – 420 nm (Fig. 3).**
- **Nano Silver Colloid is almost neutral.**
- **Nano Silver Colloid changes colorless in addition of HNO_3 after few tens minutes.**

Fig 1 Left: yellow brown viscous non-transparence liquid of 500 ppm nano colloidal Silver, with yellow color on a container wall in shaking . **Right:** 50 fold-diluted solution (10 ppm nano colloidal Silver) is shine yellow.

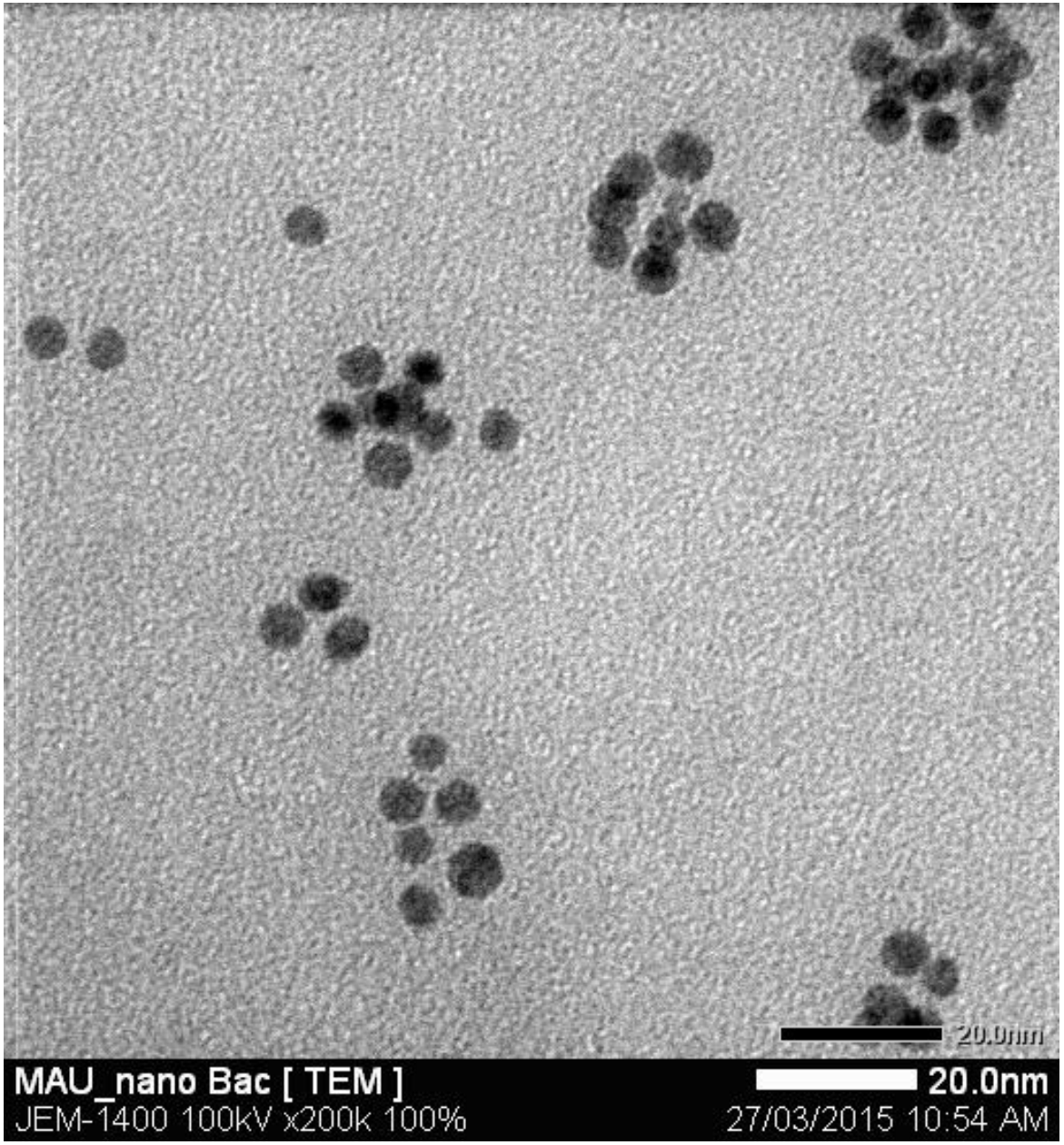
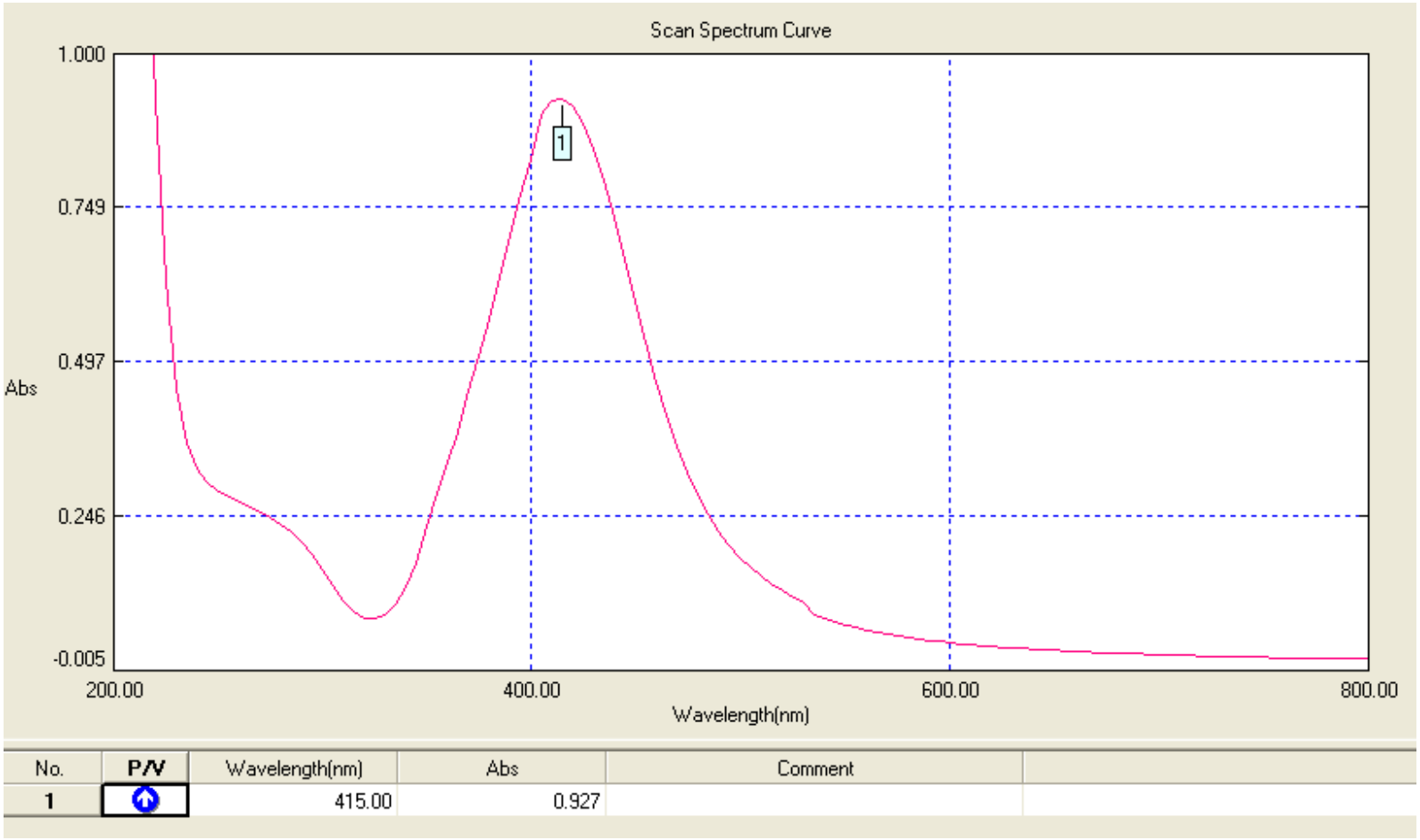


Fig 2 TEM image of nano Silver colloid showing particle size in the range of 5 – 7 nm.



No.	P/V	Wavelength(nm)	Abs	Comment
1		415.00	0.927	

Fig 3 Surface plasmon spectrum of 10 ppm nano silver colloid with maximum absorption of 0,927 at 415 nm, corresponding to concentration of metallic Silver nanoparticles of 7,13 mg/l, that means more than 70% of Silver in the liquid is in the form of metallic Silver nanoparticles.

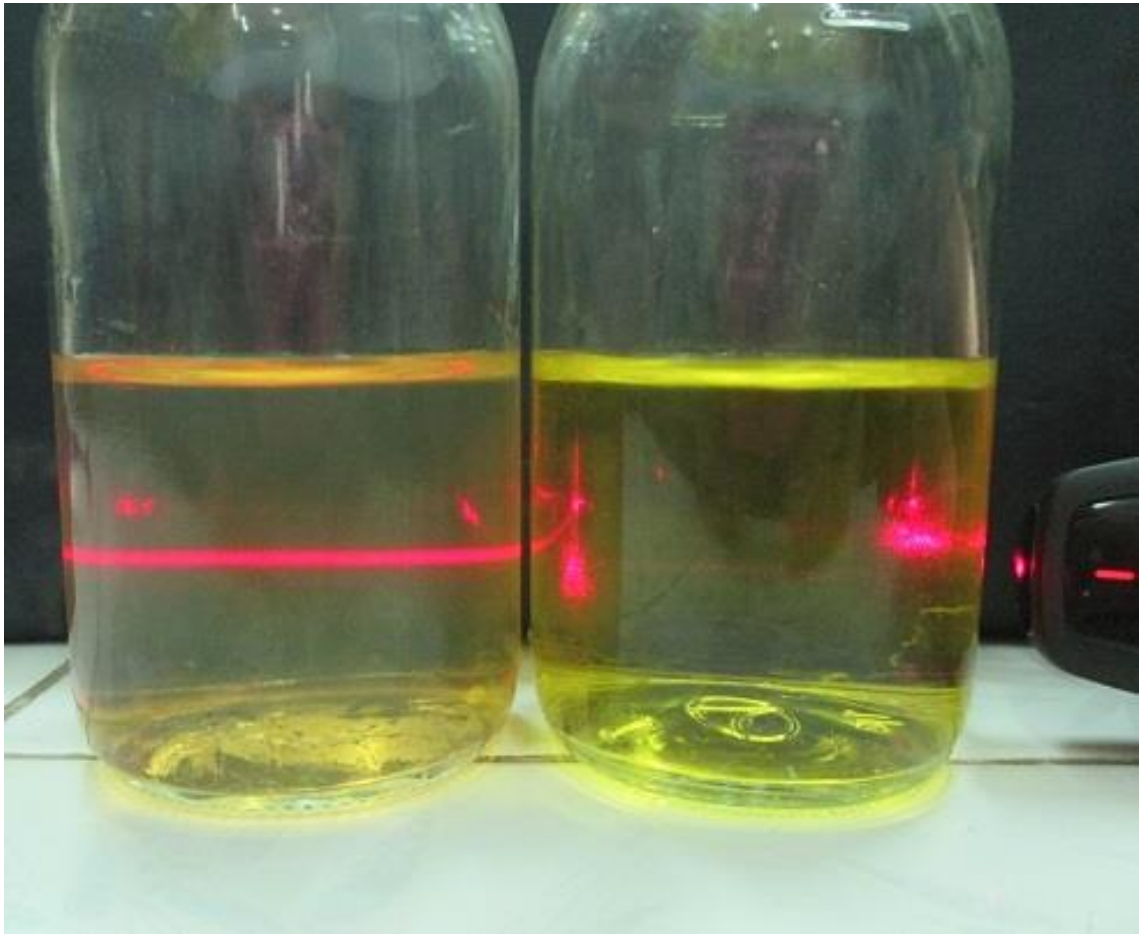


Fig 4 Laser beam passing nano-silver particle solution (left), yellow real solution of sodium chromate (right).

Fig 5 Solution of Silver Salt become opaque with white precipitation that darkens under sunlight making the solution opaque in addition of table salt, soda or alkaline (middle and right). The nano silver colloid does not show such change (left).