

# Supplementary material

## Statistical analysis

### Effect of AgNPs on plant

|                                     | SS         | DF                 | MS               | F<br>(DFn, DFd)   | P value          | P value<br>summary | R<br>squared |
|-------------------------------------|------------|--------------------|------------------|-------------------|------------------|--------------------|--------------|
| <b>Plant length (cm)</b>            |            |                    |                  |                   |                  |                    |              |
| Treatment (between columns)         | 2,055      | 7                  | 293.6            | F (7, 16) = 20.81 | $P < 0.0001$     | ns                 | 0.9010       |
| Residual (within columns)           | 225.7      | 16                 | 14.11            |                   |                  |                    |              |
| Total                               | 2,281      | 23                 |                  |                   |                  |                    |              |
| Dunnett's multiple comparisons test | Mean Diff. | 95.00% CI of diff. | Below threshold? | Summary           | Adjusted P value | B-?                |              |
| 0 vs 25                             | -0.1200    | -9.088 to 8.848    | No               | ns                | >0.9999          | c                  |              |
| 0 vs 50                             | -3.120     | -12.09 to 5.848    | No               | ns                | 0.8420           | b                  |              |
| 0 vs 75                             | -7.970     | -16.94 to 0.9975   | No               | ns                | 0.0925           | a                  |              |
| 0 vs 150                            | 8.350      | -0.6175 to 17.32   | No               | ns                | 0.0734           | d                  |              |
| 0 vs 300                            | 11.24      | 2.272 to 20.21     | Yes              | *                 | 0.0115           | e                  |              |
| 0 vs 500                            | 15.72      | 6.752 to 24.69     | Yes              | ***               | 0.0006           | f                  |              |
| 0 vs 1000                           | 20.40      | 11.43 to 29.37     | Yes              | ****              | <0.0001          | g                  |              |
| <b>Plant fresh weight (g)</b>       |            |                    |                  |                   |                  |                    |              |
| Treatment (between columns)         | 1,949      | 7                  | 278.5            | F (7, 16) = 38.42 | $P < 0.0001$     | ns                 | 0.9768       |
| Residual (within columns)           | 116.0      | 16                 | 7.247            |                   |                  |                    |              |
| Total                               | 2,065      | 23                 |                  |                   |                  |                    |              |
| Dunnett's multiple                  | Mean Diff. | 95.00% CI of diff. | Below threshold? | Summary           | Adjusted P value | B-?                |              |
| 0 vs 25                             | -0.1600    | -6.587 to 6.267    | No               | ns                | >0.9999          | c                  |              |
| 0 vs 50                             | -6.870     | -13.30 to -0.4429  | Yes              | *                 | 0.0337           | b                  |              |
| 0 vs 75                             | -11.35     | -17.78 to -4.923   | Yes              | ***               | 0.0006           | a                  |              |
| 0 vs 150                            | 6.210      | -0.2171 to 12.64   | No               | ns                | 0.0605           | d                  |              |
| 0 vs 300                            | 9.720      | 3.293 to 16.15     | Yes              | **                | 0.0025           | e                  |              |
| 0 vs 500                            | 12.78      | 6.353 to 19.21     | Yes              | ***               | 0.0002           | f                  |              |
| 0 vs 1,000                          | 16.31      | 9.883 to 22.74     | Yes              | ****              | <0.0001          | g                  |              |

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**Shoot dry weight (g)**

|                                     |            |                    |                  |                   |                    |     |        |
|-------------------------------------|------------|--------------------|------------------|-------------------|--------------------|-----|--------|
| Treatment (between columns)         | 115.0      | 7                  | 16.43            | F (7, 16) = 96.26 | $P < 0.0001$       | ns  | 0.9768 |
| Residual (within columns)           | 2.731      | 16                 | 0.1707           |                   |                    |     |        |
| Total                               | 117.8      | 23                 |                  |                   |                    |     |        |
| Dunnett's multiple comparisons test | Mean Diff. | 95.00% CI of diff. | Below threshold? | Summary           | Adjusted $P$ value | B-? |        |
| 0 vs 25                             | -0.4100    | -1.396 to 0.5764   | No               | ns                | 0.7199             | c   |        |
| 0 vs 50                             | -1.660     | -2.646 to -0.6736  | Yes              | ***               | 0.0009             | b   |        |
| 0 vs 75                             | -3.470     | -4.456 to -2.484   | Yes              | ****              | <0.0001            | a   |        |
| 0 vs 150                            | 0.9500     | -0.03635 to 1.936  | No               | ns                | 0.0615             | d   |        |
| 0 vs 300                            | 2.240      | 1.254 to 3.226     | Yes              | ****              | <0.0001            | e   |        |
| 0 vs 500                            | 2.970      | 1.984 to 3.956     | Yes              | ****              | <0.0001            | f   |        |
| 0 vs 1,000                          | 3.240      | 2.254 to 4.226     | Yes              | ****              | <0.0001            | f   |        |

**Root dry weight (g)**

|                                     |            |                     |                  |                   |                    |      |        |
|-------------------------------------|------------|---------------------|------------------|-------------------|--------------------|------|--------|
| Treatment (between columns)         | 6.067      | 7                   | 0.8667           | F (7, 16) = 105.1 | $P < 0.0001$       | **** | 0.9787 |
| Residual (within columns)           | 0.1319     | 16                  | 0.008246         |                   |                    |      |        |
| Total                               | 6.199      | 23                  |                  |                   |                    |      |        |
| Dunnett's multiple comparisons test | Mean Diff. | 95.00% CI of diff.  | Below threshold? | Summary           | Adjusted $P$ value | B-?  |        |
| 0 vs 25                             | -0.1400    | -0.3568 to 0.07679  | No               | ns                | 0.3103             | c    |        |
| 0 vs 50                             | -0.2800    | -0.4968 to -0.06321 | Yes              | **                | 0.0091             | b    |        |
| 0 vs 75                             | -0.6300    | -0.8468 to -0.4132  | Yes              | ****              | <0.0001            | a    |        |
| 0 vs 150                            | 0.2800     | 0.06321 to 0.4968   | Yes              | **                | 0.0091             | d    |        |
| 0 vs 300                            | 0.6300     | 0.4132 to 0.8468    | Yes              | ****              | <0.0001            | e    |        |
| 0 vs 500                            | 0.7900     | 0.5732 to 1.007     | Yes              | ****              | <0.0001            | f    |        |
| 0 vs 1,000                          | 0.8400     | 0.6232 to 1.057     | Yes              | ****              | <0.0001            | f    |        |

**Chlorophyll in fresh leaves (mg/g)**

|                                     |            |                    |                  |                   |                    |      |        |
|-------------------------------------|------------|--------------------|------------------|-------------------|--------------------|------|--------|
| Treatment (between columns)         | 3.291      | 7                  | 0.4701           | F (7, 16) = 159.8 | $P < 0.0001$       | **** | 0.9859 |
| Residual (within columns)           | 0.04708    | 16                 | 0.002942         |                   |                    |      |        |
| Total                               | 3.338      | 23                 |                  |                   |                    |      |        |
| Dunnett's multiple comparisons test | Mean Diff. | 95.00% CI of diff. | Below threshold? | Summary           | Adjusted $P$ value | B-?  |        |
| 0 vs 25                             | -0.009000  | -0.1385 to 0.1205  | No               | ns                | 0.9997             | c    |        |

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|------------------------------------------|------------|--------------------------|------------------|-------------------|------------------|-----|
| 0 vs 50                                  | −0.1060    | −0.2355 to<br>0.02350    | No               | ns                | 0.1344           | b   |
| 0 vs 75                                  | −0.3240    | −0.4535 to<br>−0.1945    | Yes              | ****              | <0.0001          | a   |
| 0 vs 150                                 | 0.2370     | 0.1075 to<br>0.3665      | Yes              | ***               | 0.0004           | g   |
| 0 vs 300                                 | 0.4790     | 0.3495 to<br>0.6085      | Yes              | ****              | <0.0001          | h   |
| 0 vs 500                                 | 0.6850     | 0.5555 to<br>0.8145      | Yes              | ****              | <0.0001          | i   |
| 0 vs 1,000                               | 0.7770     | 0.6475 to<br>0.9065      | Yes              | ****              | <0.0001          | j   |
| <b>Carotenoid in fresh leaves (mg/g)</b> |            |                          |                  |                   |                  |     |
| Treatment (between columns)              | 0.001155   | 7                        | 0.0001650        | F (7, 16) = 23.56 | P < 0.0001       | ns  |
| Residual (within columns)                | 0.0001121  | 16                       | 7.003e−006       |                   |                  |     |
| 0.9116                                   | 0.001267   | 23                       |                  |                   |                  |     |
| Dunnett's multiple comparisons test      | Mean Diff. | 95.00% CI of diff.       | Below threshold? | Summary           | Adjusted P value | B-? |
| 0 vs 25                                  | −0.001300  | −0.007618 to<br>0.005018 | No               | ns                | 0.9852           | c   |
| 0 vs 50                                  | −0.002700  | −0.009018 to<br>0.003618 | No               | ns                | 0.6972           | b   |
| 0 vs 75                                  | −0.007800  | −0.01412 to<br>−0.001482 | Yes              | *                 | 0.0128           | a   |
| 0 vs 150                                 | 0.007600   | 0.001282 to<br>0.01392   | Yes              | *                 | 0.0154           | d   |
| 0 vs 300                                 | 0.01030    | 0.003982 to<br>0.01662   | Yes              | **                | 0.0012           | e   |
| 0 vs 500                                 | 0.01080    | 0.004482 to<br>0.01712   | Yes              | ***               | 0.0008           | f   |
| 0 vs 1,000                               | 0.01170    | 0.005382 to<br>0.01802   | Yes              | ***               | 0.0004           | g   |

### Effect of fly ash mixed with fixed and effective concentration of AgNPs on eggplant plant growth

|                             | SS    | DF | MS    | F (DFn, DFd)     | P value    | P value summary | R squared |
|-----------------------------|-------|----|-------|------------------|------------|-----------------|-----------|
| <b>Plant length (cm)</b>    |       |    |       |                  |            |                 |           |
| Treatment (between columns) | 583.8 | 3  | 194.6 | F (3, 8) = 7.016 | P = 0.0125 | *               | 0.7246    |
| Residual (within columns)   | 221.9 | 8  | 27.74 |                  |            |                 |           |
| Total                       | 805.7 | 11 |       |                  |            |                 |           |

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| Dunnett's multiple comparisons test          | Mean Diff. | 95.00% CI of diff. | Below threshold? | Summary           | Adjusted <i>P</i> value | B-?  |        |
|----------------------------------------------|------------|--------------------|------------------|-------------------|-------------------------|------|--------|
| 0% FA+ 75 ppm AgNPs vs 20% FA+75 ppm AgNPs   | -0.1200    | -20.37 to 4.393    | No               | ns                | 0.2237                  | a    |        |
| 0% FA+ 75 ppm AgNPs vs 50% FA+ 75 ppm AgNPs  | -3.120     | -7.933 to 16.83    | No               | ns                | 0.6220                  | c    |        |
| 0% FA+ 75 ppm AgNPs vs 100% FA+ 75 ppm AgNPs | -7.970     | -1.173 to 23.59    | No               | ns                | 0.0750                  | d    |        |
| <b>Plant fresh weight (g)</b>                |            |                    |                  |                   |                         |      |        |
| Treatment (between columns)                  | 1173       | 3                  | 391.1            | F (3, 8) = 29.07  | <i>P</i> = 0.0001       | ns   | 0.9160 |
| Residual (within columns)                    | 107.6      | 8                  | 13.45            |                   |                         |      |        |
| Total                                        | 1281       | 11                 |                  |                   |                         |      |        |
| Dunnett's multiple comparisons test          | Mean Diff. | 95.00% CI of diff. | Below threshold? | Summary           | Adjusted <i>P</i> value | B-?  |        |
| 0% FA+ 75 ppm AgNPs vs 20% FA+75 ppm AgNPs   | -7.331     | -15.96 to 1.293    | No               | ns                | 0.0949                  | a    |        |
| 0% FA+ 75 ppm AgNPs vs 50% FA+ 75 ppm AgNPs  | 1.880      | -6.744 to 10.50    | No               | ns                | 0.8648                  | c    |        |
| 0% FA+ 75 ppm AgNPs vs 100% FA+ 75 ppm AgNPs | 19.59      | 10.97 to 28.21     | Yes              | ***               | 0.0005                  | e    |        |
| <b>Shoot dry weight (g)</b>                  |            |                    |                  |                   |                         |      |        |
| Treatment (between columns)                  | 29.76      | 3                  | 9.919            | F (3, 8) = 56.71  | <i>P</i> < 0.0001       | **** | 0.9551 |
| Residual (within columns)                    | 1.399      | 8                  | 0.1749           |                   |                         |      |        |
| Total                                        | 31.16      | 11                 |                  |                   |                         |      |        |
| Dunnett's multiple comparisons test          | Mean Diff. | 95.00% CI of diff. | Below threshold? | Summary           | Adjusted <i>P</i> value | B-?  |        |
| 0% FA+ 75 ppm AgNPs vs 20% FA+75 ppm AgNPs   | -2.670     | -3.653 to -1.687   | Yes              | ***               | 0.0002                  | a    |        |
| 0% FA+ 75 ppm AgNPs vs 50% FA+ 75 ppm AgNPs  | -0.4200    | -1.403 to 0.5634   | No               | ns                | 0.5043                  | c    |        |
| 0% FA+ 75 ppm AgNPs vs 100% FA+ 75 ppm AgNPs | 1.750      | 0.7666 to 2.733    | Yes              | **                | 0.0023                  | d    |        |
| <b>Root dry weight (g)</b>                   |            |                    |                  |                   |                         |      |        |
| Treatment (between columns)                  | 4.829      | 31.610             | F (3, 8) = 403.8 | <i>P</i> < 0.0001 | 4.829                   | **** | 0.9934 |
| Residual (within columns)                    | 0.031898   | 0.003986           |                  |                   |                         |      |        |
| Total                                        | 4.861      | 11                 |                  |                   |                         |      |        |
| Dunnett's multiple comparisons test          | Mean Diff. | 95.00% CI of diff. | Below threshold? | Summary           | Adjusted <i>P</i> value | B-?  |        |
| 0% FA+ 75 ppm AgNPs vs 20% FA+75 ppm AgNPs   | -0.5300    | -0.6785 to -0.3815 | Yes              | ****              | <0.0001                 | a    |        |
| 0% FA+ 75 ppm AgNPs vs 50% FA+ 75 ppm AgNPs  | 0.4500     | 0.3015 to 0.5985   | Yes              | ****              | <0.0001                 | c    |        |
| 0% FA+ 75 ppm AgNPs vs 100% FA+ 75 ppm AgNPs | 1.200      | 1.052 to 1.348     | Yes              | ****              | <0.0001                 | e    |        |
| <b>Chlorophyll in fresh leaves (mg/g)</b>    |            |                    |                  |                   |                         |      |        |
|                                              | 0.3850     | 3                  | 0.1283           |                   | <i>P</i> < 0.0001       | **** | 0.9508 |

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|                                              |            |                       |                            |              |                         |      |        |
|----------------------------------------------|------------|-----------------------|----------------------------|--------------|-------------------------|------|--------|
| Treatment (between columns)                  |            |                       |                            | F (3, 8)     |                         |      |        |
|                                              |            |                       |                            | = 51.56      |                         |      |        |
| Residual (within columns)                    | 0.019918   | 0.002489              |                            |              |                         |      |        |
| Total                                        | 0.4049     | 11                    |                            |              |                         |      |        |
| Dunnett's multiple comparisons test          | Mean Diff. | 95.00% CI of diff.    | Below threshold?           | Summary      | Adjusted <i>P</i> value | B-?  |        |
| 0% FA+ 75 ppm AgNPs vs 20% FA+75 ppm AgNPs   | 0.1250     | 0.007701 to 0.2423    | Yes                        | *            | 0.0378                  | c    |        |
| 0% FA+ 75 ppm AgNPs vs 50% FA+ 75 ppm AgNPs  | 0.3650     | 0.2477 to 0.4823      | Yes                        | ****         | <0.0001                 | d    |        |
| 0% FA+ 75 ppm AgNPs vs 100% FA+ 75 ppm AgNPs | 0.4450     | 0.3277 to 0.5623      | Yes                        | ****         | <0.0001                 | e    |        |
| <b>Carotenoid in fresh leaves (mg/g)</b>     |            |                       |                            |              |                         |      |        |
| Treatment (between columns)                  | 0.0005663  | 3                     | 0.0001888 F (3, 8) = 204.2 | $P < 0.0001$ | 0.0005663               | **** | 0.9871 |
| Residual (within columns)                    | 7.394e-006 | 8                     | 9.242e-007                 |              |                         |      |        |
| Total                                        | 0.0005736  | 11                    |                            |              |                         |      |        |
| Dunnett's multiple comparisons test          | Mean Diff. | 95.00% CI of diff.    | Below threshold?           | Summary      | Adjusted <i>P</i> value | B-?  |        |
| 0% FA+ 75 ppm AgNPs vs 20% FA+75 ppm AgNPs   | -0.008000  | -0.01026 to -0.005740 | Yes                        | ****         | <0.0001                 | cd   |        |
| 0% FA+ 75 ppm AgNPs vs 50% FA+ 75 ppm AgNPs  | 0.004000   | 0.001740 to 0.006260  | Yes                        | **           | 0.0024                  | bc   |        |
| 0% FA+ 75 ppm AgNPs vs 100% FA+ 75 ppm AgNPs | 0.01100    | 0.008740 to 0.01326   | Yes                        | ****         | <0.0001                 | e    |        |

**Table S1:** Comparative study of synthesis of AgNPs using waste materials of plant

| Plant                                             | Plant part        | Size and shape                                    | Phytoconstituents responsible for reduction of silver nitrate                                                                                                                                       | References |
|---------------------------------------------------|-------------------|---------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| Vegetable waste                                   | Peel              | Spherical, 10–90 nm                               | Alkaloids                                                                                                                                                                                           | [1]        |
| Grape and orange waste                            | Peel              | Spherical, 3–14 nm or 5–50 nm                     | Caffeic acid, gallic acid, coumaric acid, chlorogenic acid, protocatechuic acid, kaempferol, flavonoids, stilbene                                                                                   | [2]        |
| <i>P. granatum</i>                                | Peel              | Spherical, 15 nm                                  | Flavonoids and glycosides                                                                                                                                                                           | [3]        |
| Grass waste                                       | Leaves dried      | Spherical, 15 nm                                  | Alkaloids, cardiac glycosides, terpenoids and steroids, saponins, phenolic compounds, flavonoids, tannins                                                                                           | [4]        |
| pomegranate fruit peel ( <i>Punicagranatum</i> )  | Peel              | Spherical, 20–40 nm                               | Phenols, tannins, flavonoids, anthocyanins, coumarins, quinone, saponins, steroids, glycosides, cycloglycosides, terpenoids, alkaloids, fatty acids, carbohydrates, proteins and amino acids        | [5]        |
| Tea waste                                         | Waste             | Tor spherical, 45 nm                              | Phenolic compounds, caffeine, polysaccharide and tannic acid                                                                                                                                        | [6]        |
| Waste products (Apricot and black currant pomace) | Waste             | Spherical, 50–80 nm and 40–60 nm                  | Caffeic acid, naringenin, chlorogenic acid, kaempferol, catechin, epicatechin                                                                                                                       | [7]        |
| waste <i>Nypafruticans</i> fruit husk             | Waste             | Spherical, 10–15 nm or 15–20 nm                   | Phenolics and flavonoids                                                                                                                                                                            | [8,9]      |
| Waste of citrus reticulate peel                   | Peel              | Spherical, 27 nm                                  | Flavonoids, alkaloids, steroids, triterpenoids, phenolic acid and thiamine, ascorbic and citric acid                                                                                                |            |
| Phoenix dactylifera (Date palm)                   | Seeds             | Spherical, 14–30 nm                               | Phenolics, favonoids, polyphenols, aldehydes, carboxylic acids, anthraquinone, saponin, terpenoids tannin, and protein                                                                              | [10]       |
| Vigna mungo                                       | Seed hull (waste) | 100 nm                                            | Flavonoids e two leucoanthocyanins, two glycoflavones, three anthocyanins and five flavonol glycosides, proteins & vitexin, isovitexin, leucodelphinidin, leucocyanidin and delphinidin 3-glucoside | [11]       |
| <i>Annona squamosa</i>                            | Peel & seed       | Spherical, 20–40 nm                               | Alkaloids, essential oils, phenolic compounds, cyclopeptides, amino acids, pigments, and vitamins                                                                                                   | [12]       |
| Lemon                                             | Peel              | Spherical, 17.3 and 61.2 nm                       | Alkaloids, flavonoids, steroids, tannic acids and phenolic compounds                                                                                                                                | [13]       |
| Peanut                                            | Shell (Waste)     | Spherical, 10–15 nm                               | Resveratrol                                                                                                                                                                                         | [14]       |
| Teak, <i>Tectona grandis</i>                      | Leaves (waste)    | Spherical, 28 nm                                  | Antioxidants, flavonoids, terpenes, acids, sugars and proteins                                                                                                                                      | [15]       |
| Cola nitida                                       | Seed & seed shell | Spherical poly-dispersed, 12–80, 8–50 and 5–40 nm | Kolatine, alkaloids, essential oils, phenolic compounds, theobromine, caffeine and nicotine                                                                                                         | [16]       |

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Table S1: Continued

| Plant                                     | Plant part        | Size and shape      | Phytoconstituents responsible for reduction of silver nitrate        | References |
|-------------------------------------------|-------------------|---------------------|----------------------------------------------------------------------|------------|
| Cocoa pod husk ( <i>Theobroma cacao</i> ) | Peel (agro waste) | Spherical, 4–32 nm  | Gallic acid, carbohydrate, lignin, sugar & proteins                  | [17]       |
| Cavendish banana                          | Peel              | Spherica, 34 nm     | Phenols, flavonoids and tannins                                      | [18]       |
| <i>Carica papaya</i>                      | Peel              | Spherical, 10–35 nm | Chymopapain, papain, lycopene and polyphenols                        | [19]       |
| Mango                                     | Peel              | Spherical, 7–27 nm  | f pectin, cellulose, lignin, and flavonoid                           | [20]       |
| Pomelo                                    | Peel              | Spherical, 20–30 nm | Flavonoids, essential oils, cellulose, and pectin                    | [21]       |
| Onion                                     | Peel              | Spherical, 12.5 nm  | Alkaloids, glycosides, phenols, flavonoids, coumarins, volatile oils | [22]       |
| <i>Pisum sativum</i>                      | Outer Peel        | Spherical, 10–25 nm | Phenols and flavonoids                                               | [23]       |

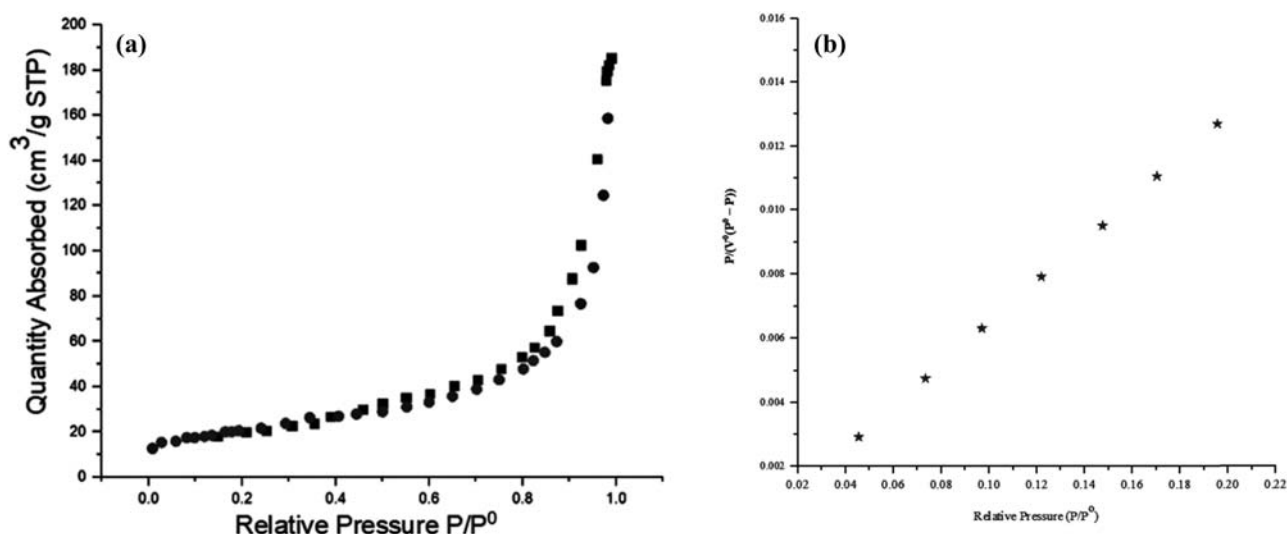


Figure S1: N<sub>2</sub> adsorption-desorption isotherms (a) and BET surface area plot of NPs (b).

## References

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