

ARTICLE

## Synthesis of Biologically Active Silver Nanoparticles by Use of N-Containing Compounds: Dual Role of Semicarbazones

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### Supporting Information

Table S1: Calculation of d-spacing and crystal planes from XRD data

|         | Without Nitrogen Atmosphere |           |                |           | Under Nitrogen Atmosphere |           |                |           | hkl |
|---------|-----------------------------|-----------|----------------|-----------|---------------------------|-----------|----------------|-----------|-----|
|         | a) Without Starch           |           | b) With Starch |           | c) Without Starch         |           | d) With Starch |           |     |
|         | 2θ                          | d-spacing | 2θ             | d-spacing | 2θ                        | d-spacing | 2θ             | d-spacing |     |
| AgNPs-1 | 38.10                       | 0.2359    | 38.12          | 0.2358    | 38.11                     | 0.2358    | 38.12          | 0.2359    | 111 |
|         | 44.28                       | 0.2043    | 44.32          | 0.2042    | 44.32                     | 0.2042    | 44.28          | 0.2043    | 200 |
|         | 64.42                       | 0.1445    | 64.44          | 0.1445    | 64.44                     | 0.1439    | 64.46          | 0.1445    | 220 |
|         | 77.38                       | 0.1232    | 77.4           | 0.1234    | 77.4                      | 0.1232    | 77.42          | 0.1232    | 311 |
| AgNPs-2 | 38.12                       | 0.2358    | 38.36          | 0.2344    | 38.12                     | 0.2358    | 38.16          | 0.2359    | 111 |
|         | 44.32                       | 0.2041    | 44.54          | 0.2032    | 44.31                     | 0.2041    | 44.26          | 0.2043    | 200 |
|         | 64.46                       | 0.1443    | 64.7           | 0.1439    | 64.44                     | 0.1444    | 64.38          | 0.1444    | 220 |
|         | 77.40                       | 0.1232    | 77.64          | 0.1228    | 77.41                     | 0.1231    | 77.38          | 0.1232    | 311 |
| AgNPs-3 | 38.1                        | 0.2359    | 38.12          | 0.2358    | 38.12                     | 0.2358    | 38.14          | 0.2359    | 111 |
|         | 44.28                       | 0.2043    | 44.32          | 0.2041    | 44.31                     | 0.2391    | 44.32          | 0.2043    | 200 |
|         | 64.42                       | 0.1444    | 64.46          | 0.1443    | 64.44                     | 0.1446    | 64.38          | 0.1445    | 220 |
|         | 77.38                       | 0.1232    | 77.4           | 0.1232    | 77.42                     | 0.1233    | 77.44          | 0.1232    | 311 |
| AgNPs-4 | 38.14                       | 0.2359    | 38.3           | 0.2347    | 38.12                     | 0.2359    | 38.18          | 0.2359    | 111 |
|         | 44.32                       | 0.2043    | 44.5           | 0.2034    | 44.31                     | 0.2042    | 44.34          | 0.2043    | 200 |
|         | 64.46                       | 0.1444    | 64.6           | 0.1441    | 64.46                     | 0.1445    | 64.46          | 0.1444    | 220 |
|         | 77.42                       | 0.1232    | 77.64          | 0.1228    | 77.42                     | 0.1235    | 77.48          | 0.1232    | 311 |
| AgNPs-5 | 38.08                       | 0.2360    | 38.1           | 0.2359    | 38.14                     | 0.2358    | 38.16          | 0.2359    | 111 |
|         | 44.22                       | 0.2046    | 44.3           | 0.2042    | 44.31                     | 0.2043    | 44.36          | 0.20433   | 200 |
|         | 64.4                        | 0.1446    | 64.44          | 0.1444    | 64.46                     | 0.1447    | 64.46          | 0.1445    | 220 |
|         | 77.36                       | 0.1232    | 77.36          | 0.1232    | 77.42                     | 0.1231    | 77.48          | 0.1232    | 311 |

Table S2: Calculation of size (D) of the Ag NPs with Starch

|         | b) Without Nitrogen atmosphere with starch |                  |              | d) Under Nitrogen with starch |                  |               |
|---------|--|------------------|--------------|-------------------------------|------------------|---------------|
|         | Peak position 2 $\theta$ (°)               | FWHM $\beta$ (°) | Size D (nm)  | Peak position 2 $\theta$ (°)  | FWHM $\beta$ (°) | Size D (nm)   |
| AgNPs-1 | 38.12                                      | 0.257            | 31.793       | 38.12                         | 0.25851          | 31.77         |
|         | 44.32                                      | 0.34             | 24.557       | 44.28                         | 0.33909          | 24.55         |
|         | 64.44                                      | 0.384            | 23.771       | 64.46                         | 0.38452          | 23.77         |
|         | 77.4                                       | 0.465            | 21.297       | 77.42                         | 0.46657          | 21.3          |
|         |  | <b>Mean</b>      | <b>25.35</b> |                               | <b>Mean</b>      | <b>25.347</b> |
| AgNPs-2 | 38.36                                      | 0.326            | 25.105       | 38.16                         | 0.25654          | 31.903        |
|         | 44.54                                      | 0.4266           | 19.5882      | 44.26                         | 0.36009          | 23.188        |
|         | 64.7                                       | 0.4544           | 20.146       | 64.38                         | 0.38562          | 23.701        |
|         | 77.64                                      | 0.5322           | 18.652       | 77.38                         | 0.45537          | 21.761        |
|         |  | <b>Mean</b>      | <b>20.87</b> |                               | <b>Mean</b>      | <b>25.13</b>  |
| AgNPs-3 | 38.12                                      | 0.2548           | 32.17        | 38.14                         | 0.22619          | 35.998        |
|         | 44.28                                      | 0.3412           | 24.47        | 44.32                         | 0.23643          | 35.324        |
|         | 64.42                                      | 0.3712           | 24.625       | 64.38                         | 0.33101          | 27.612        |
|         | 77.38                                      | 0.4489           | 22.075       | 77.44                         | 0.39936          | 24.824        |
|         |  | <b>Mean</b>      | <b>28.83</b> |                               | <b>Mean</b>      | <b>30.93</b>  |
| AgNPs-4 | 38.3                                       | 0.2886           | 28.364       | 38.18                         | 0.2259           | 36.233        |
|         | 44.5                                       | 0.4078           | 20.491       | 44.34                         | 0.25061          | 33.328        |
|         | 64.6                                       | 0.4237           | 21.596       | 64.46                         | 0.33059          | 27.659        |
|         | 77.64                                      | 0.4489           | 22.15        | 77.48                         | 0.3965           | 25.01         |
|         |  | <b>Mean</b>      | <b>23.15</b> |                               | <b>Mean</b>      | <b>30.55</b>  |
| AgNPs-5 | 38.1                                       | 0.3301           | 24.785       | 38.16                         | 0.2048           | 39.963        |
|         | 44.3                                       | 0.4801           | 17.393       | 44.36                         | 0.2508           | 33.305        |
|         | 64.44                                      | 0.4424           | 20.665       | 64.46                         | 0.315            | 29.028        |
|         | 77.36                                      | 0.5048           | 19.627       | 77.48                         | 0.36229          | 27.372        |
|         |  | <b>Mean</b>      | <b>20.61</b> |                               | <b>Mean</b>      | <b>32.41</b>  |

Table S3: Calculation of size (D) of the Ag NPs without Starch

|         | a) Without Nitrogen without starch |                  |              | c) Under Nitrogen without starch |                  |              |
|---------|------------------------------------|------------------|--------------|----------------------------------|------------------|--------------|
|         | Peak position 2 $\theta$ (°)       | FWHM $\beta$ (°) | Size D (nm)  | Peak position 2 $\theta$ (°)     | FWHM $\beta$ (°) | Size D (nm)  |
| AgNPs-1 | 38.1                               | 0.214            | 38.21        | 38.11                            | 0.25754          | 31.78        |
|         | 44.28                              | 0.266            | 31.32        | 44.32                            | 0.34009          | 24.56        |
|         | 64.42                              | 0.318            | 28.66        | 64.44                            | 0.38462          | 23.77        |
|         | 77.38                              | 0.377            | 26.25        | 77.4                             | 0.46537          | 21.29        |
|         |                                    | <b>Mean</b>      | <b>31.11</b> |                                  | <b>Mean</b>      | <b>25.31</b> |
| AgNPs-2 | 38.12                              | 0.225            | 36.22        | 38.12                            | 0.25754          | 31.79        |
|         | 44.32                              | 0.275            | 30.276       | 44.31                            | 0.34009          | 24.55        |
|         | 64.46                              | 0.33             | 27.659       | 64.44                            | 0.38462          | 23.6         |
|         | 77.4                               | 0.396            | 24.99        | 77.41                            | 0.46537          | 21.28        |
|         |                                    | <b>Mean</b>      | <b>29.78</b> |                                  | <b>Mean</b>      | <b>25.23</b> |
| AgNPs-3 | 38.1                               | 0.221            | 36.96        | 38.12                            | 0.22519          | 36.34        |
|         | 44.28                              | 0.266            | 31.325       | 44.31                            | 0.33643          | 25.32        |
|         | 64.42                              | 0.3189           | 28.665       | 64.44                            | 0.33101          | 27.62        |
|         | 77.38                              | 0.374            | 26.482       | 77.42                            | 0.39936          | 24.82        |
|         |                                    | <b>Mean</b>      | <b>30.85</b> |                                  | <b>Mean</b>      | <b>28.52</b> |
| AgNPs-4 | 38.1                               | 0.204            | 39.985       | 38.12                            | 0.225            | 36.22        |
|         | 44.28                              | 0.25             | 33.3879      | 44.31                            | 0.251            | 33.32        |
|         | 64.42                              | 0.313            | 29.155       | 64.46                            | 0.33             | 27.65        |
|         | 77.38                              | 0.36             | 27.489       | 77.42                            | 0.396            | 24.99        |
|         |                                    | <b>Mean</b>      | <b>32.5</b>  |                                  | <b>Mean</b>      | <b>30.54</b> |
| AgNPs-5 | 38.08                              | 0.337            | 24.263       | 38.14                            | 0.2048           | 35.95        |
|         | 44.22                              | 0.5081           | 16.4315      | 44.31                            | 0.2508           | 33.28        |
|         | 64.4                               | 0.47             | 19.426       | 64.46                            | 0.315            | 29.02        |
|         | 77.36                              | 0.594            | 16.6706      | 77.42                            | 0.36229          | 27.36        |
|         |                                    | <b>Mean</b>      | <b>19.19</b> |                                  | <b>Mean</b>      | <b>31.4</b>  |