**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| Author/Year | Biological source | NP type, Size (nm) | Morphology | In vitro model[a] | Dose | Exposure time | Applied test | Major genotoxicity comments | Genotoxicity | Ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Sarac et al. 2018 | *Streptomyces griseorubens* AU2 (Bacterium) | Ag, 5-20 nm | Spherical | *Salmonella typhimurium* | 50-250 μg/plate | 24 h | Ames | No genotoxicity; strongest anti-mutagenic activity in *S. typhimurium* TA98 at 250 μg/plate. | No | [1] |
| Abdelsalam et al. 2018 | *Corallina elongate* (Algae) | Ag, 7.5-25 nm | Spherical | *Triticum aestivum* L. | 10-50 ppm | 8, 16, and 24 h | Chromosomal aberration | AgNPs caused various types of chromosomal aberrations, such as incorrect orientation at metaphase, chromosomal breakage, metaphasic plate distortion, spindle dysfunction, and stickiness. | Yes | [2] |
| Remya et al. 2018 | *Turbinaria ornate* (Algae) | Ag, 21-34 nm | Spherical | Y79 | 10-50 μg/mL | 24 h | DNA fragmentation | AgNPs induced DNA fragmentation at all concentrations. | Yes | [3] |
| Raajshree et al. 2018 | *Turbinaria conoides* (Algae) | ZnO, 70-120 nm | Spherical | DLA | 50 μg/mL | 24 h | DNA fragmentation | ZnONPs induced DNA fragmentation. | Yes | [4] |
| Maity et al. 2018 | *Calotropis gigantean* (Plant) | Ag, 3-15 nm | Mostly spherical | EAC | 5.6 μg/mL | 24 h | DNA fragmentation, cell cycle analysis and western blot analysis | AgNPs induced DNA fragmentation, cell cycle arrest at the G2/M phase, upregulation of Bax and caspase-3 and downregulation of Bcl-2. | Yes | [5] |
| Lv et al. 2018 | *Shewanella loihica* PV-4 (Bacterium) | Cu, 6-20 nm | Spherical | *Escherichia coli* | 100 μg/mL | 12 h | DNA fragmentation | CuNPs induced DNA fragmentation. | Yes | [6] |
| Şahin et al. 2018 | *Punica granatum* (Plant) | Pt, Average: 20.12 nm | Cubical and spherical | MCF-7 | 25 and 100 μg/mL | 48 h | Comet | Slight DNA damage was observed at 25 μg/mL, while significant DNA damage was observed at 100 μg/mL. | Yes (dose dependent) | [7] |
| Sulaiman et al. 2018 | *Albizia adianthifolia* (Plant) | Iron oxide, 32-100 nm | Spherical | AMJ-13 and MCF-7 | 1.8 μg/mL for AMJ-13 and 7.7 μg/mL for MCF-7 | 16 h | DNA fragmentation and comet | Genotoxicity and DNA damage were confirmed by both the DNA fragmentation assay and comet assay. | Yes | [8] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Moteriya et al. 2018 | *Caesalpinia pulcherrima* (Plant) | Ag, Average: 8 nm | Spherical | Normal human lymphocytes | 2-200 μg | No data | Comet | No genotoxicity was observed at up to 50 μg, but fragmented DNA was found at 200 μg. | Yes (dose dependent) | [9] |
| Koca et al. 2018 | *Mentha aquatic* (Plant) | $TiO_2$, Average: 69 nm | Spherical | pBR322 plasmid | 62.5-500 μg/mL | 24 h | DNA fragmentation | No genotoxicity was observed at up to 250 μg/mL, but DNA deformation was found at 500 μg/mL. | Yes (dose dependent) | [10] |
| Daphedar et al. 2018 | *Albizia saman* (Plant) | Zn, 10-85 nm | Spherical | *Drimia indica* | 4–16 μg/mL | 6-24 h | Mitotic index and chromosomal aberration | ZnNPs had a mitodispersive effect on cell division and induced chromosomal abnormalities in a dose- and duration-dependent manner. | Yes | [11] |
| Yekeen et al. 2017 | Cocoa pod husk and cocoa bean (Plant) | Ag, 4-54.22 nm | Spherical | *Allium cepa* | 0.01–100 μg/mL | 24, 48 and 72 h | Mitotic index and chromosomal aberration | AgNPs had a mitodispersive effect on cell division and induced chromosomal abnormalities. | Yes | [12] |
| Syed et al. 2017 | *Rhizophora mangle* (Plant) | Ag, 10-60 nm | Spherical | *Staphylococcus aureus* | 10 mg/mL | 30 min | DNA fragmentation | AgNPs created fragmented DNA. | Yes | [13] |
| Pandurangan et al. 2017 | *Perilla frutescens* (Plant) | Ag, Average: ~23 nm | Spherical and hexagonal | HeLa | 0.1 and 0.2 mg/mL | 24 h | Fluorescent Microscopy with AO and EB staining probes | The appearance of a green nucleus in AgNPs-treated cancer cells confirmed the induction of apoptosis. Moreover, chromatin and cytoplasm were condensed in the treated cells. | Yes | [14] |
| Jha et al. 2017 | *Citrus maxima* (Plant) | Ag, 2-50 nm | Spherical | B16-F10 | 10 μg/mL | 48 h | DNA fragmentation | AgNPs caused clear fragmentation of genomic DNA. | Yes | [15] |
| Fierascu et al. 2017 | *Melissa officinalis* L. (Plant) | Ag, Au and Ag-Au, Average: 13 nm for Au, 10 nm for Ag, and 100 nm for Ag- | Spherical, triangular, hexagonal, rhombic, etc. | *Allium cepa* | 10-20% | 48 h | Mitotic index and chromosomal aberration | AgNPs were found not active on nuclear DNA damage. The AuNPs appeared nucleoprotective, but were aggressive in generating clastogenic aberrations in *A. cepa* root meristematic cells. | No (Ag) Yes (Au) | [16] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Verma et al. 2017 | *S. aureus*, *B. thuringiensis* (gram-positive bacteria), and *E. coli*, *S. typhimurium* (gram-negative bacteria) | Au bimetallic Ag, 4.8-29.3 nm | Spherical | HCT116 | 50 and 250 µg/mL | 24 and 48 h | Cell cycle analysis via propidium iodide staining of the nucleus | AgNPs biosynthesized from gram-negative strains showed higher cytotoxicity than AgNPs biosynthesized from gram-positive strains and induced greater oxidative stress, morphological changes, apoptosis, and cell cycle arrest in the G0/G1 phase. | Yes | [17] |
| Prasad et al. 2017 | *Asparagus racemosus* (Plant) | CdS, 2-8 nm | Mostly spherical | Normal human lymphocytes | 0.01 µg/µL | 1 h | Comet | No DNA damage was observed. | No | [18] |
| Syed et al. 2017 | *Turbinaria conoides* (Algae) | $TiO_2$, 60-100 nm | Irregular | *Salmonella typhimurium* viz., and normal human lymphocytes | 0.312–5 mg/mL | 48 h for bacterial samples and 3-6 h for human samples | Ames and chromosomal aberration | $TiO_2$NPs caused no DNA damage against *S. typhimurium* viz. Biosynthesized NPs had a geno-protective nature and nonmutagenic effect on normal human lymphocytes. | No | [19] |
| Saha et al. 2017 | *Swertia chirata* (Plant) | Ag, Average: 20 nm | Mostly spherical | *Allium cepa* | 5–20 µg/mL | 4 h | Chromosomal aberration | Various chromosomal aberrations were observed even at low concentrations of AgNPs. | Yes | [20] |
| Panda et al. 2017 | *Calotropis gigantea* L. (Plant) | ZnO, Average: 48.6 nm | Spherical to hexagonal | *Lathyrus sativus* L. | 0–100 mg/L | 15 h | Comet | ZnONPs induced significant DNA damage in a dose-dependent manner. | Yes (dose dependent) | [21] |
| Moteriya et al. 2017 | *Caesalpinia pulcherrima* (Plant) | Ag, 2-22 nm Average: 12 nm | Spherical | Normal human | 2–200 µg/mL | 96 h | Comet and chromosomal aberration | DNA fragmentation and chromatid gaps in chromosomes were observed at 200 µg/mL, and these | Yes | [22] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | lymphocytes | | | | effects were less prominent at lower AgNP concentrations. | (dose dependent) | |
| Datkhile et al. 2017 | *Nothapodytes foetida* (Plant) | Ag, No data | No data | K562 | 5-25 μg/mL | 48 h | DNA fragmentation | AgNPs caused extensive double-strand breaks and DNA damage. | Yes | [23] |
| Guilger et al. 2017 | *Trichoderma harzianum* (Fungus) | Ag, 20-30 nm | Spherical | *Allium cepa* for chromosomal aberration assay. 3T3, HeLa, HaCaT, V79 and A549 cells for comet assay. | $[0.15–3.16] \times 10^{12}$ NPs/mL for the chromosomal aberration assay and $[0.15-0.47] \times 10^{12}$ NPs/mL for the comet assay | 24 h for the chromosomal aberration assay and 1 h for the comet assay | Comet and chromosomal aberration | AgNPs caused DNA damage in all of the mammalian cell lines tested as well as changes in the mitotic index and the alteration index due to chromosomal aberrations. | Yes | [24] |
| Barua et al. 2017 | *Thuja occidentalis* (Plant) | Ag, 10-15 nm Average: 12.7 nm | Spherical | Super coiled DNA of pBR322 plasmid and calf thymus DNA | 6.25–25 μg/mL | 48 h | DNA fragmentation | No DNA strand scission was observed in the supercoiled DNA of pBR322 or calf thymus DNA. | No | [25] |
| Bhanumathi et al. 2017 | *Syzygium cumini* (Plant) | Ag, 15-30 nm | Spherical | MCF-7 and MDA-MB-231 | 10–100 μg/mL | 24 and 48 h | Western blot | AgNPs activated p53 and Bax by downregulating Bcl-2 expression. | Yes | [26] |
| Das et al. 2017 | *Syzygium cumini* (Plant) | Au, Average: 15 nm | Heterogeneously shape | Normal human lymphocytes | No data | No data | Chromosomal aberration | No genotoxicity was found. | No | [27] |
| Baghbani-Arani et al. 2017 | *Artemisia tournefortiana* Rchb (Plant) | Ag, Average: 22.89±14.82 nm | Spherical | HT29 and HEK293 | 61.38 μg/mL for HEK293 and 40.71 μg/mL for HT29 | 24 h | Quantitative real-time PCR | The Bax/Bcl-2 ratio was upregulated. In detail, an increase and decrease in the mRNA level of Bax and the Bcl-2 expression in cell lines were observed. | Yes | [28] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Banerjee et al. 2017 | *Mentha arvensis* (Plant) | Ag, 3-9 nm | Spherical | MCF-7 and MDA-MB-231 | 1.56–12.5 μg/mL | 2-48 h | Western blot | Upregulation of PARP1, P53, P21, Bax and cleaved caspase-9 was observed in MCF-7 cells, whereas Bcl2 was downregulated. In MDA-MB-231 cells, the mutant P53 protein was downregulated, whereas PARP1, P53, P21, Bax, cleaved caspase-9, procaspase-3 and cleaved caspase-3 proteins were upregulated. | Yes | [29] |
| Khalid et al. 2017 | a) *Dictyosphaerium* sp. strain HM1 (DHM1) b) *Dictyosphaerium* sp. strain HM2 (DHM2) c) *Pectinodesmus* sp. strain HM3 (PHM3) (Microalgae) | Ag, Average: a) 22.5 nm for DHM1-AgNPs; b) 47.5 nm for DHM2-AgNPs; c) 57.5 nm for PHM3-AgNPs | DHM1-AgNPs and DHM2-AgNPs: spherical; PHM3-AgNPs: ovoid shape | MCF-7 and HepG2 | 10–50 μg/mL | 24 h | DNA fragmentation | AgNPs caused DNA cleavage and fragmentation. | Yes | [30] |
| Datkhile et al. 2017 | *Nothapodytes foetida* (Plant) | Ag, 10-50 nm | Spherical | MCF-7, HeLa, MCF-7, HCT15 and K562 | 1–20 μg/mL | 48 h | DNA fragmentation | AgNPs caused DNA damage, upregulation of P53 and caspase-3 and downregulation of Bcl2 genes. | Yes | [31] |
| Chandrakasan et al. 2017 | *Xenorhabdus stockiae* KT835471 (Bacterium) | Ag and Au, Average: 14±6 nm for AgNPs and 14±5 nm for AuNPs | AgNPs: spherical; AuNPs: spherical, ovoid and triangular | A549 | 29.4 μg/mL for AgNPs and 49.8 μg/mL for AuNPs | 24 h | DNA fragmentation | AgNPs and AuNPs induced apoptosis through ROS-mediated DNA damage. | Yes | [32] |
| Das Nelaturi et al. 2017 | *Allamanda Cathartica* L. (Plant) | Ag, Average: 35 nm | Spherical | PBMC | 20–100 μg/mL | 4 h | DNA fragmentation | AgNPs caused DNA cleavage and fragmentation. | Yes | [33] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Daphedar et al. 2017 | *Albizia saman* (Jacq.) Merr. (Plant) | Ag, 55-83 nm | Spherical, triangular and irregular | *Drimia indica* (Roxb.) Jessop | 25–100% | 6-24 h | Chromosomal aberration | AgNPs created abnormalities in chromosomes such as a sticky metaphase, single bridge at anaphase, normal anaphase with micronuclei, anaphase with chromosome fragments, laggard anaphase, multipolarity at anaphase, disturbed metaphase, diagonal anaphase, and C-metaphase. | Yes | [34] |
| Şuţan et al. 2016 | *Asplenium scolopendrium* L. (Plant) | Ag, No data | No data | *Allium cepa* L. | No data | 6-24 h | Chromosomal aberration | The plant extract supplemented with AgNPs incurred a variable incidence of C-mitosis, anaphase bridges, and sticky chromosomes alongside vagrant chromosomes. | Yes | [35] |
| Mishra et al. 2016 | *Hibiscus sabdariffa* (Plant) | Au, Average: 30 nm | Spherical | U87 | 1–2.5 ng/mL | 24 h | DNA fragmentation | AuNPs caused DNA damage in a dose-dependent manner. | Yes (dose dependent) | [36] |
| Qi et al. 2016 | *Magnetospirillum gryphiswaldense* MSR-1 (Bacterium) | $Fe_3O_4$, Average: 30 nm | Subspheroidal | ARPE-19 | 10–200 µg/mL | 24 h | Comet | Biogenic $Fe_3O_4$ caused less DNA damage than chemically synthesized $Fe_3O_4$. However, both were found to be genotoxic and caused DNA damage. | Yes | [37] |
| Perde-Schrepler et al. 2016 | *Cornus mas* (Plant) | Au, 2-24 nm Average: 12.079 ± 3.588 nm | Round and oval | HaCaT | 6–15 µg/mL | 24-48 h | Comet | AuNPs showed low toxicity, caused minimal ROS production and did not induce additional DNA lesions or an increase in inflammatory cytokine production. | No | [38] |
| Suganya et al. 2016 | *Mimosa pudica* (Plant) | Au, Average: 12.5 nm | Spherical | MDA-MB-231 and MCF-7 | 4 µg/mL for MDA-MB-231 and 6 µg/mL for MCF-7 | 48 h | Comet | AuNPs caused significant damage to the DNA and lengthened the tails of condensed DNA compared to that observed in the control in both cell lines. | Yes | [39] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Suganya et al. 2016 | *Musa paradisiaca* (Plant) | Au, <50 nm | Spherical | MCF-7 and MDA-MB-231 | 2 μg/mL for MDA-MB-231 and 8 μg/mL for MCF-7 | 48 h | Comet | Increased length of the comet tail (DNA damage) induced by AuNPs in both cell lines. | Yes | [40] |
| Panda et al. 2016 | *Mangifera indica* L. (Plant) | Ag, 14-44.6 nm | Spherical | *Lathyrus sativus* L. | 1–100 mg/L | 3 h | Chromosomal aberration (CA), micronucleus formation and comet | AgNPs fabricated under four different reaction conditions caused DNA damage and were genotoxic. Moreover, using polyvinyl polypyrrolidone in the green synthesis of AgNPs resulted in an attenuation of their genotoxicity. | Yes | [41] |
| Farah et al. 2016 | *Adenium obesum* (Plant) | Ag, 10-30 nm | Mostly spherical | MCF-7 | 50–150 μg/mL | 24 h | Comet | AgNPs were found to be toxic at low concentrations ($IC_{50}$=73 μg/mL), with enhanced intracellular levels of ROS resulting in DNA damage, apoptosis and autophagy. | Yes | [42] |
| Elshawy et al. 2016 | *Penicillium aurantiogriseum* (Fungus) | Ag, Average: 12.7 nm | Spherical | MCF-7 | 0.44–14 μg/mL | 24 h | DNA fragmentation | AgNPs resulted in DNA strand breakage. | Yes | [43] |
| Jang et al. 2016 | *Lonicera hypoglauca* (Plant) | Ag, 4.99-25.83 nm | Spherical | MCF-7 | 500 μg/mL | 48 h | Western blot | AgNPs upregulated the p53 tumor suppressor gene and the subsequent increases in the expression of pro-apoptotic Bax, caspase-3 and caspase-9. In addition, AgNPs downregulated the mRNA levels of anti-apoptotic Bcl-2 and curtailed the JAK/STAT signaling in MCF-7 cancer cells. | Yes | [44] |
| Prabhu et al. 2016 | *Setaria verticillata* L (Plant) | Ag, Average: 12±4 nm | Spherical | MCF-7 and A549 | 32.5-1000 μg/mL | 24 h | DNA fragmentation | AgNPs resulted in double-strand breaks and the formation of DNA ladders in agarose gel, which are characteristic of apoptosis. | Yes | [45] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Prasannaraj et al. 2016 | a) *Plumbago zeylanica* b) *Semecarpus anacardium* c)*Terminalia arjuna* (Plant) | Ag, a) 80–98, b) 60–95 c) 34–70 nm | Spherical and cuboid | HepG2 and PC3 | 1-100 µg/mL | 48 h | DNA fragmentation | AgNPs resulted in DNA ladder formation and DNA damage. | Yes | [46] |
| Kayalvizhi et al. 2016 | *Curculigo orchioides* (Plant) | Ag, 15-18 nm | Spherical | MDA-MB-231 | 10–100 µg/mL | 48 h | DNA fragmentation | AgNPs resulted in DNA strand break. | Yes | [47] |
| Selvi et al. 2016 | *Padina tetrastromatica* (Algae) | Ag, 40-50 nm | Predominantly round | MCF-7 | 50-200 µg/mL | 24 h | DNA fragmentation | AgNPs did not cause any DNA fragmentation at 50 µg/mL and induced very little fragmentation at 100 µg/mL, and moderate apoptotic fragmentation at 200 µg/mL. | Yes (dose dependent) | [48] |
| Chandramohan et al. 2016 | *Azadirachta indica* (Plant) | Ag, 30-50 nm | Mostly spherical | Peripheral erythrocytes of goldfish (*Carassius auratus*) | 0-12 ppm | 72 and 96 h | Comet and micronucleus assay | AgNPs caused no significant damage at doses below 12 ppm. However, after 72 and 96 h, AgNPs at 12 ppm resulted in nuclear abnormalities and damage to the nuclear membrane. | Yes (dose dependent) | [49] |
| Kajani et al. 2016 | *Taxus baccata* (Plant) | Ag, 75.1 and 91.2 nm | Spherical | Caov-4 | 2.5 and 5 µg/mL | 24 and 48 h | DNA fragmentation | AgNPs caused slight DNA fragmentation after 24 h at 2.5 µg/mL but obvious laddering patterns and double-strand breaks after 48 h at 5 µg/mL. | Yes (dose dependent) | [50] |
| Kalangi et al. 2016 | *Anethum graveolens* (Plant) | Ag, Average: 35 nm | Mostly spherical | *Leishmania donovani* | 50 µM | 48 h | DNA fragmentation | AgNPs created no DNA breaks. | No | [51] |
| He et al. 2016 | *Dimocarpus longan Lour.* (Plant) | Ag, 9-32 nm | Spherical | PC-3 | 10 µg/mL | 24 h | Western blot | AgNPs inhibited prostatic cancer PC-3 cells and induced a | Yes | [52] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | decrease in stat 3, bcl-2, and survivin expression and an increase in caspase-3 expression. | | |
| Bhakya et al. 2016 | *Helicteres isora* (Plant) | Ag, 16-95 nm Average: 25.55 nm | Mostly spherical and oval | KB | 70 µg/mL | 48 h | Comet | AgNPs caused DNA damage as fragmented DNA tails, olive tails, and tail length alterations. | Yes | [53] |
| Iram et al. 2016 | *Fusarium oxysporum* (Fungus) | $Tb_2O_3$, Average: 10 nm | Mostly spherical | MG-63 and Saos-2 | 0.102 µg/mL | 24 h | Nuclear morphology analysis by DAPI staining | $Tb_2O_3$NPs caused nuclear fragmentation associated with DNA damage, including typical tubular staining patterns and condensed nuclei. | Yes | [54] |
| Mata et al. 2016 | *Abutilon indicum* (Plant) | Au, 1-20 nm | Spherical | HT-29 | 210 µg/mL | 24 and 48 h | TUNEL, western blot, and cell cycle analysis | AuNPs caused negligible necrosis. In addition, AuNPs caused cell cycle arrest at the G1/S transition phase. Furthermore, the expression levels of active caspases (3, 8, 9) increased with an increasing AuNP concentration. | Yes | [55] |
| Azmath et al. 2016 | *Colletotrichum* sp. (Fungus) | Ag, 20-50 nm | Spherical, nearly spherical, triangular and hexagonal | *Escherichia coli* | 25-100 µg/mL | 30 min | DNA fragmentation | AgNPs caused DNA deformation and damage. | Yes | [56] |
| Ashe et al. 2016 | *Cucurbita maxima* (Plant) | Ag, Average: 76.10 ± 0.8 nm | Spherical | Saos-2 | 0.05-0.25 mM | 12 h | Comet | A combination of AgNPs with glucose-derived glycation products caused DNA damage and cell death via apoptotic pathways, while glycated products alone induced cell death by necrosis. | Yes | [57] |
| Balashanmugam et al. 2016 | *Cassia Roxburghii* (Plant) | Au, 25-35 nm | Spherical | HepG2 | 30 µg/mL | 24 h | DNA fragmentation | AuNPs created fragmented DNA. | Yes | [58] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Balaji et al. 2016 | *Trichoderma viride* (Fungus) | Ag, 5-40 nm | No data | MCF-7 | 40 and 130 μg/mL | 24 h | DNA fragmentation and western blot | AgNPs created fragmented DNA. Moreover, western blot analysis showed inhibition of Bcl-2 and activation of Bax. | Yes | [59] |
| Qayyum et al. 2016 | *Caryota urens, Pongamia glabra, Hamelia patens, Thevetia peruviana, Calendula officinalis, Tectona grandis, Ficus petiolaris, Ficus busking, Juniper communis, Bauhinia purpurea* (Plant) | Ag, 1-60 nm | Spherical, quasi-spherical, triangular and pentagonal | pBR322 plasmid | 50 and 250 μg/mL | 12 h | DNA fragmentation | AgNPs led to mild or little plasmid damage at 50 μg/mL, while severe plasmid DNA damage was found at 250 μg/mL. | Yes (dose dependent) | [60] |
| Thiruvengadam et al. 2015 | *Bacillus marisflavi* (Bacterium) | Ag, 2-11 nm Average: 8 nm | Mostly spherical | Turnip (*Brassica rapa* ssp. rapa) | 1-10 mg/L | 12 h | DNA fragmentation, comet, and TUNEL | AgNPs caused extensive DNA damage and altered the expression of genes involved in a variety of metabolic pathways as well as the inhibition of chlorophyll and anthocyanin biosynthesis and an overproduction of ROS. | Yes | [61] |
| Parandhaman et al. 2015 | *Rhizopus oryzae* (Fungus) | Si-Ag nanocomposite, Average: 20±4.5 nm | Mostly spherical | Genomic and plasmid DNA of *Escherichia coli* and *Pseudomonas aeruginosa* | 0.25-2 mg/mL | 5 h | DNA fragmentation | Exposure to Si-Ag nanocomposites resulted in a decrease in genomic and plasmid DNA band intensity in the treated cells in comparison to the control cells, indicating DNA damage, in a dose-dependent manner. | Yes | [62] |
| Jeyaraj et al. 2015 | *Podophyllum hexandrum* (Plant) | Ag and Au, Ag: 12-40 nm; | No data | MCF-7 | 100 and 200 μg/mL for Ag and | 24 h | DNA | AgNPs and AuNPs caused the upregulation of Bax, BCl2, caspase-6, caspase-9, PARP, and p53; the | Yes | [63] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
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| | | Au: 5-35 nm | | | 200 and 400 μg/mL for Au | | fragmentation and western blot | downregulation of Bcl-2 and DNA fragmentation. | | |
| Mata et al. 2015 | *Abutilon indicum* (Plant) | Ag, 5-25 nm | Spherical | COLO 205 | 4-12 μg/mL | 24 h | TUNEL and cell cycle assay | AgNPs induced no significant necrosis up to 8 μg/mL but caused 4% necrosis at 12 μg/mL. In addition, AgNPs arrested the cell cycle at the G1/S transition stage. | Yes (dose dependent) | [64] |
| Zahir et al. 2015 | *Euphorbia prostrate* (Plant) | Ag and $TiO_2$, Average: 12.82± 2.50 nm for AgNPs and 83.22± 1.50 nm for $TiO_2$NPs | AgNPs: Spherical; $TiO_2$NPs: circular and irregularly shaped | *Leishmania donovani* | 12.5-50 μg/mL | 24 h | DNA fragmentation and TUNEL | DNA breakage was not extensive after AgNP exposure. However, high-molecular-weight DNA fragments of ~700 bp were observed, indicating that the mode of cell death may be largely due to necrosis. | Yes | [65] |
| Manna et al. 2015 | *Lentinus squarrosulus* (Mont.) Singer (Fungus) | Ag, Average: 2.78 ± 1.47 nm | Mostly spherical | *Escherichia coli* | 40 μg/mL | 8 h | Flow cytometry | AgNPs caused an increase in side scattering intensity, supporting the internalization of AgNPs inside bacterial cells. | Yes | [66] |
| Subbaiya et al. 2015 | *Nocardia mediterranei*-5016 (Fungus) | Ag, Average: 49.98 nm | Rod-shaped | NCI-H460 | 2-20 μg | 24 and 48 h | Comet | AgNPs caused DNA damage in a time-dependent manner. | Yes (time dependent) | [67] |
| Gandhiraj et al. 2015 | *Momordica charantia* (Plant) | Ag, Average: 96.3 nm | Spherical | MCF-7 | 12-100 μg/mL | 24 h | DNA fragmentation | AgNPs caused DNA damage, resulting in fragmented DNA. | Yes | [68] |
| Dwivedi et al. 2015 | *Pseudomonas aeruginosa* strain JS-11(Bacterium) | Ag, 5–23 nm | Mostly spherical | MCF-7 | 0.5-10 μg/mL | 24 h | Cell cycle analysis and real-time PCR | The genes BCl2, cyclin D1, DNAJA1, E2F transcription factor 1, GPX1 and HSPA4 were upregulated. Some genes from the DNA damage and repair pathway, including XRCC2 and DDB1, were | Yes | [69] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

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|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | negatively downregulated. Moreover, cell cycle analysis revealed an increase in the subG1 peak with a concomitant reduction in the G1 phase. | | |
| Baskar et al. 2015 | *Vitex negundo* L. (Plant) | Ag, 10-20 nm | Mostly spherical | *Brassica rapa* ssp. *pekinensis* | 100-500 μg/mL | 10 days | DNA fragmentation | Concentration-dependent DNA damage was observed in AgNP-treated plants. AgNPs at 500 μg/mL induced ROS generation and DNA damage. | Yes (dose dependent) | [70] |
| Chung et al. 2015 | *Eclipta prostrate* (Plant) | ZnO, Average: 29±1.3 nm | Triangular, radial, hexagonal, rod-shaped, and rectangular | HepG2 | 1-500 μg/mL | 24 h | DNA fragmentation | ZnONPs caused DNA damage as fragmented DNA. | Yes | [71] |
| Baharara et al. 2015 | *Achillea biebersteinii* (Plant) | Ag, 10-40 nm | Spherical and pentagonal | MCF-7 | 1–100 μg/mL | 24 and 48 h | Gene expression by RT-PCR | AgNPs downregulated the anti-apoptotic genes of the Bcl-2 family and unregulated the pro-apoptotic members, such as Bax. | Yes | [72] |
| Ramar et al. 2015 | *Solanum trilobatum* (Plant) | Ag, 12.50-41.90 nm | Spherical | MCF-7 | 5-50 μg/mL | 24 h | Western blot | AgNPs downregulated Bcl-2 but upregulated the activation of caspase-3 and caspase-9. | Yes | [73] |
| Gurunathan et al. 2015 | *Bacillus tequilensis* (Bacterium) | Ag, Average: 20 nm | Spherical | MDA-MB-231 | 0-25 μg/mL | 24 h | TUNEL and western blot | AgNPs induced DNA damage and cellular apoptosis via activation of p53, p-Erk1/2, and caspase-3 signaling and downregulation of Bcl-2. | Yes | [74] |
| Gurunathan et al. 2015 | *Artemisia princeps* (Plant) | Ag, Average: 20 nm | Spherical | *Helicobacter pylori*, *Helicobacter felis* | 1 μg/mL | 12 h | DNA fragmentation | AgNPs induced DNA fragmentation. | Yes | [75] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Ismail et al. 2015 | *Pleurotus ostreatus* (Fungus) | Ag, 13.1-24.1 nm; Average: 17.5 nm | Spherical | MCF-7 and HepG2 | No data | 48 h | DNA fragmentation | AgNPs induced DNA fragmentation and apoptosis in HepG2 and MCF-7 cells via suppression of Bcl-2 gene expression; upregulation of BAX; downregulation of Bcl2; and simulation of caspase, P53 and cytochrome c gene expression. | Yes | [76] |
| Namvar et al. 2015 | *Sargassum muticum* (Algae) | ZnO, 10-15 nm | Hexagonal | WEHI-3 | 20-100 μg/mL | 24-72 h | Western blot | ZnONPs caused a decrease in Bcl-2 expression and an increase in the level of Bax, suggesting disruption of mitochondrial membranes. | Yes | [77] |
| Parveen et al. 2015 | *Cassia auriculata* (Plant) | Ag and Au, Average: 21 nm for Au and 20 nm for Ag | Spherical | A549, LNCap-FGC, and MDA-MB | 10-30 μg/mL | 24 h | DNA fragmentation | Ag and AuNPs caused DNA cleavage and exhibited genotoxicity in all cell lines. | Yes | [78] |
| Raman et al. 2015 | *Rosa indica* (Plant) | Ag, 23.52-60.83 nm | Spherical | HCT-15 | 30 μg/mL | 24 h | Western blot | AgNPs downregulated Bcl-2 and upregulated the activation of caspase-3 and caspase-9. | Yes | [79] |
| Krishnaraj et al. 2015 | *Malva crispa* (Plant) | Ag, 5-50 nm | Spherical | *Bacillus cereus, Staphylococcus aureus, Listeria monocytogenes, Salmonella typhi,* and *Salmonella enterica* | 1-3 mM | 30 min-24 h | DNA fragmentation | AgNPs did not show any genotoxic effects against any of the tested bacterial strains. | No | [80] |
| Hullikere et al. 2015 | *Tragia involucrate* (Plant) | Ag, Within 100 nm | Rod-shaped | MOLT-4 | 10-100 μg/mL | 24-72 h | DNA diffusion assay | DNA diffusion slightly increased, indicating genotoxicity. | Yes | [81] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Govindaraju et al. 2015 | *Sargassum vulgare* (Algae) | Ag, Average: 10 nm | Spherical | HL60 | 2.84 µg/mL | 48 h | DNA fragmentation | AgNPs induced DNA fragmentation. | Yes | [82] |
| Ortega et al. 2015 | *Cryptococcus laurentii* (BNM 0525) (Fungus) | Ag, Average: 35±10 nm | No data | MCF7, T47D, and MCF10-A | 5 µg/mL | 12 h | Western blot | Caspase-9 was overexpressed, and caspase-3/7 activity was increased in MCF7 and T47D; in MCF10-A cells, caspase and Bcl-2 were maintained at constant levels. | Yes | [83] |
| Raman et al. 2015 | *Pleurotus djamor* var. (Plant) | Ag, 5-50 nm | Spherical | PC3 | 10 and 40 µg/mL | 24 h | Comet | Cells treated with 40 µg/mL AgNPs showed a higher tail DNA than cells treated with 10 µg/mL AgNPs and control cells. | Yes (dose dependent) | [84] |
| Vijaya et al. 2014 | *Ocimum sanctum* (Plant) | Ag, Average: >100 nm | Spherical | Normal human lymphocytes | 50-200 µg/mL | 48 h | Chromosomal aberration | AgNPs reduced the chromosomal damages due to cyclophosphamide and showed an antigenotoxic activity. | No | [85] |
| Rajasekharreddy et al. 2014 | *Sterculia foetida* L. (Plant) | Ag, 6.9±0.2 nm | Spherical | HeLa | 16 µg/mL | 24 h | DNA fragmentation | AgNPs created extensive double-strand breaks. | Yes | [86] |
| Krishnasamy et al. 2014 | *Indigofera aspalathoides* (Plant) | Ag, No data | No data | Hep3B | 194.65 µg/mL | 24 and 48 h | DNA fragmentation | AgNPs induced nucleosomal DNA fragmentation. | Yes | [87] |
| Prasad et al. 2014 | *Terminalia arjuna* (Plant) | Se, 10-80 nm | Spherical | Normal human lymphocytes | 0.01 µg/µL | 1 h | Comet | SeNPs prevented the manifestation of genotoxic effects in lymphocytes treated with arsenite. | No | [88] |
| Sarkar et al. 2014 | *Alternaria alternate* (Fungus) | ZnO, 45-150 nm Average: 75±5 nm | Spherical, triangular and hexagonal | Normal human lymphocytes | 125-1000 µg/mL | 3 h | Comet | A significant increase in DNA fragmentation was induced at 1000 µg/mL. | Yes (dose dependent) | [89] |
| Kumar et al. 2014 | *Paederia foetida* (Plant) | Ag, 2-20 nm Average: 8.9±3.6 nm | Spherical | Calf thymus and *Escherichia coli* | 0-50 µg/mL | 1 h for calf thymus and | DNA fragmentation | No genotoxicity was found. | No | [90] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | 24 h for E. *coli* | | | | |
| El-Kassas et al. 2014 | *Corallina officinalis* (Algae) | Au, Average: 14.57±1 nm | Spherical | MCF-7 | 0.75-6 μg/mL | 48 h | DNA fragmentation | No DNA damage was found up to 1.5 μg/mL; however, significant DNA damage was observed at 3 and 6 μg/mL. | Yes (dose dependent) | [91] |
| Chowdhury et al. 2014 | *Macrophomina phaseolina* (Fungus) | Ag, 5-40 nm; most were 16-20 nm | Spherical | pZPY112 plasmid | 0.51-5.1 μg | 2 h | DNA fragmentation | Genotoxicity was manifested as the degradation of plasmids, even at low concentrations. | Yes | [92] |
| Krishnaraj et al. 2014 | *Acalypha indica* Linn (Plant) | Ag and Au, 20-30 nm | Spherical | MDA and MB-231 | 1-100 μg/mL | 48 h | DNA fragmentation | Both AgNPs and AuNPs caused DNA damage and fragmentation. | Yes | [93] |
| Lima et al. 2014 | *Fusarium oxysporum* (Fungus) | Ag, Average: 40.3±3.5 nm | Spherical | 3T3, normal human lymphocytes and *Allium cepa* | 0.5-10 μg/mL | 1 h for 3T3 cells and human lymphocytes and 24 h for the *Allium cepa* assay | Comet and chromosomal aberration | AgNPs at 5 and 10 μg/mL had a genotoxic effect; however, at 0.5-1 μg/mL, no genotoxicity was observed. | Yes (dose dependent) | [94] |
| Singh et al. 2014 | *Anabaena doliolum* (Bacterium) | Ag, 10-50 nm | Spherical | COLO 205 | 1-50 μg/mL | 24 h | DNA fragmentation | DNA fragmentation increased significantly with an increasing AgNP concentration. | Yes (dose dependent) | [95] |
| Varun et al. 2014 | *Argemone mexicana* (Plant) | Au, Average: 26±5 nm | Spherical | MCF-7 | 100 μg/mL | 48 h | DNA fragmentation | AuNPs caused extensive double-stranded DNA breaks. | Yes | [96] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Subbaiya et al. 2014 | *Streptomyces olivaceus* sp-1392 (Bacterium) | Ag, Average: 200 nm | Spherical | NCI-H460 | 9.48 and 12.52 μg/mL | 24 and 48 h | Comet | AgNPs caused DNA breakage and damage by increasing the amount of tail DNA, tail length, and olive tail moment. | Yes | [97] |
| Ashokkumar et al. 2014 | *Cajanus cajan* (Plant) | Au, 9-41 nm | Spherical | HepG2 | 246 μg/mL | 48 h | Comet | AuNPs caused DNA damage by increasing the amount of tail DNA, tail length, tail moment, and olive tail moment in HepG2 cells. | Yes | [98] |
| Jeyaraj et al. 2014 | *Podophyllum hexandrum* L. (Plant) | Au, Average: 15 nm | Spherical and triangular | HeLa | 20 μg/mL | 24 h | Comet, western blot, and DNA fragmentation | AuNPs increased the amount of tail DNA, tail length, tail moment and olive tail moment in HeLa cells. A DNA ladder was formed in AuNP-treated cells. The level of Bcl-2 expression was reduced, and the level of Bax was increased. | Yes | [99] |
| Prasad et al. 2013 | Lemon plant | Se, 60-80 nm | Spherical | Normal human lymphocytes | 0.01 μg/μL | 1 min | Comet | SeNPs caused less cell death of lymphocytes and prevented DNA damage when cells were exposed to UVB radiation. | No | [100] |
| Rosarin et al. 2013 | *Phyllanthus emblica* (Plant) | Ag, Average: 188 nm | Spherical and cubic | Hep2 | 20 μg/mL | 24 h | DNA fragmentation | AgNPs caused DNA fragmentation. | Yes | [101] |
| Neveen et al. 2013 | *Aspergillus terreus* (Fungus) | Ag, 20-140 nm | Spherical | *Aspergillus fumigatus* | 15 μg/mL | 36 h | Comet | AgNPs caused DNA damage and an increase in DNA tail length. | Yes | [102] |
| Mohanty et al. 2013 | a) *Alstonia macrophylla* (Plant) b) *Trichoderma* sp. (Fungus) | Ag, Average: a) 50 nm; b) 100 nm | Spherical | RAW264.7 macrophages | 5 and 10 ppm | 12 h for the comet assay and 6 h for the micronucleus assay | Comet and micronucleus assay | No DNA damage was observed at 5 ppm; however, significant micronuclei formation and DNA damage were observed at 10 ppm for both phytosynthesized and mycosynthesized AgNPs. | Yes (dose dependent) | [103] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Jeyaraj et al. 2013 | *Sesbania grandiflora* L. (Plant) | Ag, Average: 22 nm | Spherical | MCF-7 | 0-50 μg/mL | 24 and 48 h | Comet | AgNPs caused DNA breakage in the form of tail formation. | Yes | [104] |
| Jeyaraj et al. 2013 | *Podophyllum hexandrum* L. (Plant) | Ag, 12-40 nm | Mostly spherical | HeLa | 20 μg/mL | 24 h | Comet, western blot, and DNA fragmentation | AgNPs increased the amount of tail DNA, tail length, tail moment and olive tail moment in HeLa cells. A DNA ladder was formed in AgNP-treated cells. The level of Bcl-2 expression was reduced, and the level of Bax was increased. | Yes | [105] |
| Prabhu et al. 2013 | *Vitex negundo* L. (Plant) | Ag, 5-47 nm | Spherical | HCT15 | 20 and 100 μg/mL | 48 h | Comet | AgNPs caused long tail formation and DNA damage. | Yes | [106] |
| Geetha et al. 2013 | *Couroupita guianensis* (Plant) | Au, 7-48 nm | Spherical, triangular, tetragonal and pentagonal with irregular contours | HL-60 | 60-180 μg/mL for the comet assay and 0-150 μg/mL for the DNA fragmentation assay | 48 h | Comet and DNA fragmentation | AuNPs caused long tail formation (DNA damage) and genotoxicity. | Yes | [107] |
| Govender et al. 2013 | *Albizia adianthifolia* (Plant) | Ag, 4-35 nm | Mostly spherical | A549 | 43 μg/mL | 6 h | Comet and western blot | Fragmentation of DNA was significantly induced by AgNPs. In addition, AgNPs increased the expression of p53, Bax and PARP-1. | Yes | [108] |
| Chunyan et al. 2013 | a) Mint; b) Coffee; c) Ginger (Plant) | Ag, a) 5-10 nm; b) 30-40 nm; c) 5-10 nm and 30-40 nm | Mostly spherical | HeLa and HepG2 | 20 μg/mL | 24 h | Cell cycle analysis | AgNPs caused DNA damage followed by cell cycle arrest in the G2/M stage and eventually cell death through apoptosis. This DNA damage was more significant for AgNPs synthesized by a mint-mediated method. | Yes | [109] |
| Gurunathan et al. 2013 | *Ganoderma neo-japonicum* (Fungus) | Ag, 10-15 nm | Spherical | MDA-MB-231 | 6 μg/mL | 24 h | DNA fragmentation and TUNEL | AgNPs induced cell death through ROS generation, caspase-3 activation, and DNA fragmentation. | Yes | [110] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Gurunathan et al. 2013 | *Bacillus funiculus* (Bacterium) | Ag, Average: 20 nm | Mostly spherical | MDA-MB-231 | 8.7 µg/mL | 24 h | DNA fragmentation | AgNPs induced DNA fragmentation. | Yes | [111] |
| Wu et al. 2013 | *Polyporus rhinoceros* (Fungus) | Se, Average: 50 nm | Spherical | A549 | 10 and 20 µM | 24 h | TUNEL-DAPI costaining assay and cell cycle analysis | SeNPs induced G2/M phase arrest. In addition, DNA fragmentation and nuclear condensation were detected. | Yes | [112] |
| Gurunathan et al. 2013 | *Escherichia fergusoni* (Bacterium) | Ag, 10-80 nm | Spherical | MCF-7 | 17.4 µg/mL | 24 h | DNA fragmentation | AgNPs induced DNA fragmentation. | Yes | [113] |
| Tamboli et al. 2013 | *Exiguobacterium* sp. KNU1 (Bacterium) | Ag, 5-50 nm | Spherical | *Salmonella typhimurium*, *Pseudomonas aeruginosa*, *Escherichia coli* and *Staphylococcus aureus* | 25 µg/mL | 4 h | DNA fragmentation | AgNPs revealed the fragmentation of DNA in the *E. coli* cells; however, no significant DNA damage was found in other bacteria. | Yes | [114] |
| Das et al. 2013 | *Phytolacca decandra, Gelsemium sempervirens, Hydrastis canadensis* and *Thuja occidentalis* (Plant) | Ag, Average: approximately 100 nm | Mostly spherical | A375 | 80 and 160 µg/mL | 24 h | Comet, cell cycle assay and DNA fragmentation | A DNA fragmentation study showed smear DNA in agarose gel, indicating DNA damage, while the comet assay did not show any fragmented DNA. AgNPs inhibited DNA synthesis and cell proliferation through G2/M cell cycle arrest. | | [115] |
| Bhattacharyya et al. 2012 | *Phytolacca decandra* (Plant) | Ag, Average: 91 nm | Spherical | A549 | 80 and 100 µg/mL | 24 h | Comet and DNA fragmentation | AgNPs caused DNA fragmentation as well as an increase in DNA tail formation, indicating genotoxicity. | Yes | [116] |
| Mishra et al. 2012 | *Azadirachta indica* (Neem) (Plant) | Ag, 2–18 nm | Spherical | SiHa | 4, 8, 30, and 60 µg/mL | 48 h | DNA fragmentation | AgNPs caused extensive double-strand breaks, thereby yielding a ladder-like appearance on agarose gel. | Yes | [117] |

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Bendale et al. 2012 | *Dolichos biflorous, Ocimum sanctum, Euphorbia neriifolia, Sesbania grandiflora, Piper betle, Calospropris procera, Asteracantha longifolia* (Plant) | Pt, Average: 137.5 nm | Cubic | A375 | 100 μg/mL | 24, 48, and 72 h | DNA fragmentation | PtNPs induced DNA damage in a time-dependent manner. | Yes (time dependent) | [118] |
| Sarkar et al. 2011 | *Alternaria alternate* (Fungus) | Ag, 20-45 nm Average: 28±4 nm | Spherical | Normal human lymphocytes | 50-400 μg/mL | 3 h | Comet | AgNPs caused significant DNA tail formation at 300 μg/mL; however, slight DNA damage was observed at lower concentrations. | Yes (dose dependent) | [119] |
| Satyavani et al. 2011 | *Citrullus colocynthis* (Plant) | Ag, Average: 31 nm | Spherical | HEp-2 | 500 nM | 6 h | DNA fragmentation | AgNPs caused extensive double-strand breaks. | Yes | [120] |
| Panda et al. 2011 | *Pandanus odorifer* (Plant) | Ag, 24-55 nm Average: 37±11 nm | Mostly spherical | *Allium cepa* L. | 5-80 μg/mL | 12, 24 and 48 h | Comet and micronucleus assay | AgNPs induced DNA damage in a dose-dependent manner. DNA damage was significantly enhanced at doses ≥20 μg/mL. | Yes (dose dependent) | [121] |
| Singh et al. 2010 | *Actinobacter* spp. (Bacterium) | $TiO_2$ and ZnO, Average: 5.5 nm for $TiO_2$ and 7 nm for ZnO | Spherical | A431 | $10^{-3}$- $10^{-12}$ M | 3 h | Comet | ZnONPs at concentrations up to $10^{-5}$ M caused DNA damage as a significant increase in the percentage of tail DNA. $TiO_2$ at concentrations up to $10^{-3}$ M did not cause a significant increase in percentage tail DNA. | Yes (dose dependent) | [122] |

[a]**Cancer and normal cell Lines:** Y79 (human retinoblastoma), DLA (Dalton's lymphoma), EAC (Ehrlich's ascites carcinoma), MDA-MB-231 (human breast adenocarcinoma), MCF-7 (human breast adenocarcinoma), A549 (human lung adenocarcinoma), A375 (human malignant melanoma), AMJ-13 (human invasive ductal carcinoma), HeLa (human cervical cancer), B16-F10 (mouse melanoma), K562 (human leukemic), HT29 (human colorectal adenocarcinoma), HepG2 (human hepatocellular carcinoma), HCT-15 (human Dukes' type C, colorectal adenocarcinoma), U87 (human glioblastoma), PC-3 (human prostate carcinoma), Caov-4 (human

**Table S1.** *In vitro* genotoxicity studies of biologically synthesized MNPs.

ovarian adenocarcinoma), KB (human carcinoma), MG-63 (human osteosarcoma), Saos-2 (human osteosarcoma), HT-29 (human colorectal adenocarcinoma), COLO 205 (human Dukes' type D, colorectal adenocarcinoma), NCI-H460 (human nonsmall cell lung carcinoma), WEHI-3 (mouse leukemia), LNCap-FGC (human prostate carcinoma), MDA-MB (human adenocarcinoma mammary gland), MOLT-4 (human acute lymphoblastic leukemia), T47D (human ductal carcinoma), MCF10-A (human breast epithelial cell), Hep3B (human hepatocellular carcinoma), Hep2 (human carcinoma), HCT116 (human colorectal carcinoma), HL-60 (acute promyelocytic leukemia), SiHa (human cervical cancer cell), A431 (human epithelial carcinoma), RAW264.7 (mouse macrophage), ARPE-19 (human retinal pigment epithelium cell), HaCaT (human keratinocyte), normal human lymphocyte, PBMC (peripheral blood mononuclear cell), HEK293 (human embryonic kidney cell), 3T3 (mouse embryo), and V79 (hamster lung fibroblast).

**Table S2.** *In vivo* genotoxicity studies of biologically synthesized MNPs.

| Author/Year | Biological source | NP type, Size (nm) | Morphology | *In vivo* model | Dose | Exposure time | Genotoxicity assay | Major genotoxicity comments | Genotoxicity (Yes or No) | Ref |
|---|---|---|---|---|---|---|---|---|---|---|
| Adiguzel et al. 2018 | *Streptomyces* sp. AOA21 (Bacterium) | Ag, 35-60 nm | Spherical | *Saccharomyces cerevisiae* | 12.5-100 μg/mL | 3 h | Comet | AgNPs at 12.5 and 25 μg/mL led to insignificant DNA damage. However, AgNPs at 50 and 100 μg/mL resulted in significant DNA damage. | Yes (dose dependent) | [123] |
| Pandiarajan et al. 2018 | *Morus alba* (Plant) | Ag, No data | No data | Larva of mulberry silkworm *Bombyx mori* | 1-100 ppm | No data | DNA fragmentation, and Bm-actin amplification | A high mortality rate at 100 ppm and a moderate mortality rate at 10 ppm were observed during larval-pupal transition and pupal-adult transition. Significant DNA fragmentation was observed at 100 ppm. In addition, Bm-actin marker gene amplification revealed the null amplification at 10 and 100 ppm, respectively. | Yes (dose dependent) | [124] |

**Table S2.** *In vivo* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Gavade et al. 2017 | *Ziziphus jujuba* (Plant) | $Cu_xO$/ZnO, Ag@$Cu_xO$/ZnO and Au@$Cu_xO$/ZnO (x= I and II), 15-40 nm | Hexagonal and irregular | *Cyprinus carpio* blood | No data | No data | Comet | NPs significantly induced genotoxicity even at low concentrations. | Yes | [125] |
| Ishwarya et al. 2017 | *Cissus quadrangularis* (Plant) | Ag, No data | No data | Larvae of *Poecilia reticulata* fishes and adults of the microcrustacean *Ceriodaphnia cornuta* | 10, 20 and 40 µg/mL | 24 h | DNA fragmentation | AgNPs at 40 µg/mL led to remarkable DNA damage in *C. cornuta*, whereas in *P. reticulata*, 20 µg/mL AgNPs led to DNA damage. | Yes | [126] |
| Krishnaraj et al. 2016 | *Malva crispa* Linn. (Plant) | Ag, 5-50 nm | Spherical | Zebrafish (*Danio rerio*) | 23.7-331.8 µg/L | 96 h | Micronuclei and nuclear abnormality test | AgNPs showed micronuclei and nuclear abnormalities such as blebbed nuclei, lobed nuclei, and notched nuclei in peripheral blood cells, indicating genotoxicity. | Yes | [127] |
| Beheshti et al. 2013 | *Bacillus* sp. MSh-1 (Bacterium) | Se, 80-220 nm | Spherical | *Leishmania major* promastigotes | 1-150 µg/mL | 24 h | DNA fragmentation | SeNPs induced DNA fragmentation in a dose-dependent manner. | Yes (dose dependent) | [128] |
| Antony et al. 2013 | *Ficus religiosa* (Plant) | Ag, 5-35 nm | Spherical | Dalton's ascites lymphoma (DAL) in a mouse model | 25-100 µg/mL | 11 days | DNA fragmentation | AgNPs caused DNA damage in DAL cells by initiating apoptosis. | Yes | [129] |

**Table S2.** *In vivo* genotoxicity studies of biologically synthesized MNPs.

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Sukirtha et al. 2011 | *Areca catechu* Linn. (Plant) | Ag, Average: 80 nm | Spherical | Mice bearing DAL tumor cells | 600-1000 μg | 10 days | DNA fragmentation | AgNPs created fragmented DNA in DAL-induced tumor cells. | Yes | [130] |

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