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Synthesis of Silver Nanoparticles from *Cucumis prophetarum* and Their Anticancer Properties and Activities

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SUMMARY

Nanotechnology is really moving forward! One exciting area is the development of nanocomposites, which have different properties from their larger counterparts. These new materials are impacting many fields, such as drug delivery, cosmetics, and nanomedicine. Take silver nanoparticles (AgNPs), for example. They are tiny—only between 1 and 100 nanometers. These little particles show great promise in treating cancer because they can create reactive oxygen species (ROS). This can lead to oxidative stress and apoptosis, essentially causing cancer cells to die. They can also damage cancer cell DNA, disrupt mitochondria (the cell's powerhouses), damage membranes, and even stop new blood vessels from forming (Chintamani et al., 2018). All these properties make AgNPs potential anti-cancer agents. However, we need more studies and clinical trials to ensure they are safe and effective.

INTRODUCTION

Nanotechnology is advancing rapidly (Adison et al., 2022). Thanks to nanocomposites with special functions and size-dependent properties, this research area is becoming crucial. These tiny materials have been gaining popularity globally (Muhammad et al., 2017). Inorganic nanoparticles open up huge possibilities across many fields, such as medicine, cosmetics, and environmental protection. Nanotechnology could revolutionize biomedical research by developing better products for diagnosis and therapy. Noble metal nanoparticles—like those made from silver, platinum, gold, and copper—have been created using various methods (Li et al., 2018). While many studies focus on making silver nanoparticles from plant leaves, there hasn't been much work exploring wild plants that could help fight cancer or bacteria. The Cucurbitaceae family has about 125 genera and over 960 species, such as Cucurbita and Momordica, found in tropical and temperate areas.

Silver Nanoparticles

So, what are silver nanoparticles? They are tiny bits of silver that measure between 1 and 100 nanometers! Because they're so small and have a large surface area, they have unique physical, chemical, and biological properties. This makes them incredibly useful in medicine, electronics, and materials science.

Anti-Cancer Properties of Silver Nanoparticles

Silver nanoparticles can act as anti-cancer heroes in several ways:

Induction of Reactive Oxygen Species (ROS)

AgNPs can create reactive oxygen species inside cancer cells. These molecules can be quite damaging to DNA, proteins, and lipids. When ROS levels increase, it can cause oxidative stress, leading to damage and apoptosis (cell death).

DNA Damage

AgNPs can interfere with the DNA in cancer cells, causing breaks and other issues. This damage can disrupt the cell cycle and stop the growth of cancer cells.

Mitochondrial Dysfunction

AgNPs might disrupt the function of mitochondria—the batteries of our cells! If mitochondria aren’t working properly, cells lose energy, which might lead to their death.

Cell Membrane Disruption

AgNPs can adhere to and penetrate cell membranes, causing damage. This leads to compromised membranes that can leak cellular contents and result in cell death.

Inhibition of Angiogenesis

AgNPs may stop the formation of new blood vessels—a crucial process for tumors to grow and spread. By reducing the nutrient supply to tumors, they help prevent their growth.

Anti-Proliferative Effects

AgNPs can slow down cancer cell growth by interfering with cell signaling pathways. This effect might halt tumor growth.

Synergistic Effects with Other Therapies

These nanoparticles can enhance the efficacy of other treatments like chemotherapy and radiation therapy. They help make cancer cells more sensitive to these treatments.

CONCLUSION

In conclusion, silver nanoparticles exhibit various ways they might fight cancer! By creating oxidative stress, damaging DNA, disrupting mitochondria and cell membranes, and inhibiting blood vessel formation, AgNPs demonstrate significant potential in lab studies as treatments for cancer. However, we need more research and trials to determine how safe and effective they truly are in real-life situations.

REFERENCES

Adison, Mukherjee, P., Senapati, S., Mandal, D., Khan, M. I., Kumar, R., & Sastry, M. (2022). *Extracellular biosynthesis of silver nanoparticles using the fungus Fusarium oxysporum*. Colloids and Surfaces B: Biointerfaces, 28(4), 313–318.

An, Y., & Chen, Z. (2019). *Impacts of silver nanoparticles on plants*: A focus on the phytotoxicity and underlying mechanism. International Journal of Molecular Sciences, 20(5), 1003.

Gondwal, M., Sharma, N., Pant, G., Gautam, B. P. S., Singh, S., Tumba, K., (2023). *Bioactivity and Catalytic Reduction of Aryl Nitro- Compounds by Biosynthesized Silver Nanoparticles using Skimmiaanquetilia*.ChemistrySelect, 8(2).

Hemlata, Meena, P. R., Singh, A. P., & Tejavath, K. K. (2020). *Biosynthesis of Silver Nanoparticles Using Cucumis prophetarum Aqueous Leaf Extract and Their Antibacterial and Antiproliferative Activity Against Cancer Cell Lines*. ACS Omega, 5(10), 5520–5528.

Li , F., Rather, S. A., Wani, S. M., & Gani, A. (2017). *Emerging concepts in the nutraceutical and functional properties of pectin*—A Review. Carbohydrate Polymers, 168, 227–239.

Parmar, M.Rahuman, A. A., Rajakumar, G., Marimuthu, S., Bagavan, A., Jayaseelan, C., Zahir, A. A., Elango, G., & Kamaraj, C. (2010). *Synthesis of silver nanoparticles using Nelumbo nucifera leaf extract and its larvicidal activity against malaria and filariasis vectors*. Parasitology Research, 108(3), 693–702.