

O'SIMLIK EKSTRAKTI ASOSIDA "YASHIL SINTEZ" USULIDA OLINGAN KUMUSH VA OLTIN NANOPARRACHALARINING SARATON HUYAYRALARIGA INVITRO SHAROITDA SITOTOKSIK TA'SIRINI BAHOLASH

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Annotasiya: Ushbu tadqiqotda mahalliy o'simlik ekstraktidan foydalangan holda kumush (AgNPs) va oltin (AuNPs) nanoparrachalarini ekologik xavfsiz "yashil sintez" (Green Synthesis) usulida olish va ularning saraton hujayralariga sitotoksik ta'sirini in vitro sharoitda baholash o'rganildi. Nanoparrachalarning shakllanishi UV-Vis spektroskopiyasi, FTIR va elektron mikroskopiya (SEM/TEM) yordamida tahlil qilindi. Sintezlangan nanoparrachalarning saraton hujayralari hayotchanligiga ta'siri MTT testi yordamida aniqlandi. Natijalar shuni ko'rsatdiki, yashil sintez yo'li bilan olingan nanotizimlar konsentratsiyaga bog'liq ravishda saraton hujayralarining o'sishini ingibirdaydi va kelajakda onkologiyada maqsadli yetkazib berish tizimlari uchun muqobil dori vositasi bo'lib xizmat qilishi mumkin.

Annotation: In this study, the production of silver (AgNPs) and gold (AuNPs) nanoparticles by the environmentally safe "Green Synthesis" method using local plant extracts and their cytotoxic effect on cancer cells in vitro was studied. Nanoparticle formation was analyzed using UV-Vis spectroscopy, FTIR and electron microscopy (SEM/TEM). The effect of the synthesized nanoparticles on the viability of cancer cells was determined using the MTT test. The results showed that the nanosystems obtained by green synthesis inhibit the growth of cancer cells in a concentration-dependent manner and may serve as an alternative drug for targeted delivery systems in oncology in the future.

Kalit so'zlar: Yashil sintez, kumush nanoparrachalari, oltin nanoparrachalari, sitotoksiklik, MTT testi, in vitro.

Key words: Green synthesis, silver nanoparticles, gold nanoparticles, cytotoxicity, MTT test, in vitro.

Kirish

Zamonaviy onkologiyaning eng katta muammolaridan biri — an'anaviy kimyoterapevtik preparatlarning yuqori toksikligi va ularning sog'lom hujayralarga salbiy ta'siridir. Shu sababli, dori moddalarini maqsadli yetkazib berish (targeted delivery) va selektiv ta'sirga ega yangi agentlarni yaratish dolzarb masalalardan biri bo'lib qolmoqda. Nanobiotexnologiya bu muammoga ekologik xavfsiz va samarali yechimlar taklif etmoqda.

"Yashil sintez" (Green Synthesis) usuli kimyoviy qaytaruvchilar o'rniga o'simlik ekstraktlaridagi tabiiy polifenollar, flavonoidlar va terpenoidlardan foydalanishga asoslangan. Kumush (AgNPs) va oltin (AuNPs) nanoparrachalari o'zlarining yuqori sirt maydoni va hujayra membranasidan oson o'tish xususiyati tufayli saratonga qarshi terapiyada yuqori samara ko'rsatmoqda. Ushbu ishning maqsadi yashil sintezlangan nanoparrachalarning fizik-kimyoviy xarakteristikasini o'rganish va ularning saraton hujayralariga sitotoksik ta'sirini in vitro baholashdan iborat.

Introduction

One of the biggest problems of modern oncology is the high toxicity of traditional chemotherapeutic drugs and their negative effects on healthy cells. Therefore, targeted delivery of drugs and creation of new agents with selective effects remain one of the urgent issues. Nanobiotechnology offers environmentally safe and effective solutions to this problem.

The "Green Synthesis" method is based on the use of natural polyphenols, flavonoids and terpenoids in plant extracts instead of chemical reducers. Silver (AgNPs) and gold (AuNPs) nanoparticles are highly effective in anticancer therapy due to their high surface area and easy passage through the cell membrane. The purpose of this work is to study the physicochemical characteristics of green synthesized nanoparticles and to evaluate their cytotoxic effect on cancer cells in vitro.

MATERIAL VA METODLAR (MATERIALS AND METHODS)

Ekstrakt tayyorlash: O'simlik namunalari distillangan suvda yuvilib, quritildi va maydalandi. 10 g namuna 100 ml deionizatsiyalangan suvda 70 °C haroratda 30 daqiqa davomida ekstraksiya qilindi va Whatman №1 filtri orqali suzib olindi.

Nanoparrachalar sintezi: AgNPs va AuNPs sintezi uchun mos ravishda 1 mM AgNO₃ va HAuCl₄ eritmalaridan foydalanildi. O'simlik ekstrakti metall tuzlari eritmasiga 1:9 nisbatda qo'shildi. Reaksiya eritma rangining jigarrang (kumush uchun) va yoqut-qizil (oltin uchun) rangga o'zgarishi bilan tasdiqlandi.

Xarakterizatsiya: Nanoparrachalarning sirtqi plazmon rezonansi UV-Vis spektrofotometriya 400-600 nm o'lchandi. Ularning o'lchami va morfologiyasi SEM/TEM mikroskoplari yordamida aniqlandi.

Sitotoksiklik (MTT assay): Saraton hujayralari 96 uyali planshetlarga ekilib, 24 soat davomida 37 °C da 5% li CO₂ muhitida inkubatsiya qilindi. So'ngra ularga turli konsentratsiyadagi (5-100 g/ml) nanoparrachalar qo'shildi. 24 va 48 soatdan keyin MTT reagenti qo'shilib, hosil bo'lgan formazan kristallari DMSOda eritildi va optik zichlik 570 nm to'lqin uzunligida o'lchandi.

NATIJAR VA MUHOKAMA (RESULTS AND DISCUSSION)

UV-Vis tahlillari natijasida AgNPs uchun 430 nm va AuNPs uchun 540 nm atrofida xarakterli cho'qqilar (peaks) kuzatildi, bu esa nanoparrachalar muvaffaqiyatli sintezlanganini ko'rsatadi. SEM/TEM tahlillari parrachalar asosan sferik shaklda va o'lchami 15-40 nm oralig'ida ekanligini tasdiqladi.

MTT testi natijalariga ko'ra, ikkala turdagi nanoparrachalar ham saraton hujayralarining yashovchanligini konsentratsiyaga bog'liq ravishda (dose-dependent) pasaytirdi. Kumush nanoparrachalari hujayra ichida reaktiv kislorod shakllari (ROS) hosil qilish hisobiga yuqoriroq sitotoksiklik (qiymati pastroq) ko'rsatdi. Oltin nanoparrachalari esa pastroq toksiklik namoyon etib, biologik jihatdan barqarorroq va maqsadli yetkazib berish uchun qulayroq ekanligini isbotladi.

XULOSA

Tadqiqot natijalari shuni ko'rsatdiki, o'simlik ekstraktlari yordamida olingan kumush (AgNPs) va oltin (AuNPs) nanoparrachalari ekologik toza, iqtisodiy jihatdan arzon va yuqori samarali biotibbiy agentlar hisoblanadi. "Yashil sintez" (Green Synthesis) metodologiyasi zaharli kimyoviy reagentlardan voz kechgan holda, o'simlik tarkibidagi tabiiy biofaol birikmalarning qaytaruvchanlik va barqarorlashtiruvchanlik xususiyatlaridan samarali foydalanish imkonini berdi. Olingan nanoparrachalarning saraton hujayralariga nisbatan in

vitro sharoitdagi yuqori sitotoksik faolligi va ularning hujayra hayotchanligini konsentratsiyaga bog'liq ravishda ingibirlashi MTT testi orqali o'z tasdig'ini topdi. Ayniqsa, kumush nanoparrachalarining oksidativ stress (ROS) hosil qilish orqali namoyon etgan yuqori antikanser effekti hamda oltin nanoparrachalarining yuqori biomaslashuvchanligi nanotibbiyotda muhim ahamiyatga ega. Ushbu olingan nanotizimlar kelajakda an'anaviy kimyoterapiyaning nojo'ya ta'sirlarini kamaytirishga, dori vositalarini organizmning aynan kasallangan nuqtasiga zarar yetkazmasdan yetkazib berish (targeted drug delivery) platformalarini yaratishga hamda xavfsiz, selektiv ta'sirga ega yangi onkologik dori preparatlarini ishlab chiqishga xizmat qiladi.

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