

Natural humic substances interfere with multiple stages of the replication cycle of human immunodeficiency virus

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RATIONALE: Despite the wide application of HAART, the number of HIV-positive patients continues to grow steadily. This shows an urgent need for a directed search for new antiviral drugs against HIV. The purpose of this study was to investigate the anti-HIV activity of humic substances.

METHODS: The corresponding HS samples were humic (HA), fulvic (FA), and humatmelanic (HMA) acids. The evaluation of anti-HIV efficacy of HA was performed using laboratory adapted HIV strains and different cell targets. The level of virus replication was detected by p24 HIV1 antigen ELISA. Cytotoxicity was determined using the MTT assay.

RESULTS: The results showed that the HA and HMA fractions exhibited a distinct antiviral activity within the concentration range from 0.78 ug/mL to 100 ug/mL with respect to HIV1, while fulvic acids showed much less activity. Time of addition assay show that HS have antiviral activity at the stage of HIV fusion, and at the stage of reverse transcription of DNA to RNA, and at the stage of integration of viral DNA into the genome of the host cell. The results of HIV1cell attachment assay show that all HS blocked cellular HIV1 attachment reducing an amount of the GFP-spots per cell.

CONCLUSIONS: The low cytotoxicity and high anti-HIV activity of HS indicate that these substances hold significant promise as a safe and efficacious antiviral drugs. The ability of HS to interfere with multiple stages of the HIV replication cycle of is viewed as an added benefit suggesting potential for further development as antiviral drugs.