

## *Abstract*

Hexavalent chromium [Cr (VI)] compound has been accepted as one of the major environmental metal pollutants. It poses various toxic health hazards in human beings, as because of wide industrial use of it. In the present research, investigation has been conducted to select the dose and duration dependent response of chromium (VI) and its toxicity in liver and lung tissues. It was noted that the toxicity was maximum at the dose of 800 µg per 100 gm body weight per day for the period of 28 day treatment of hexavalent chromium. It may be observed that the reduced body weight of chromium-treated rats might be owing to direct effects of chromium content. This decreased body weight was not reflected in the individual organ weights. On the other hand, during our research on the toxicity of Cr (VI) in liver and lungs tissues, it was observed that enhanced lipid peroxidation and conjugated diene associated with antioxidants (GSH, GSSG, GPx, GR, G-S-T, SOD and CAT) depletion in liver and lungs may be due to enhanced utilization during detoxification of chromium.

The inhibitory action of Cr (VI) on mitochondrial respiration was detected in isolated rat liver mitochondria. Present study displays a remarkable increase of the MDA, conjugated dienes levels and NO production in liver and lungs mitochondria in chromium induced rats. These results may be due to generation of ROS and oxidative damage in inner mitochondrial membrane. Not only the levels of GSH and GSSG have diminished but also the activities of SOD, GPx, GR and G-S-T have decreased in liver and lungs mitochondria in response to chromium might be owing to increased oxidative stress.

*Andrographis paniculata* Nees, has been used in India for the treatment of many diseases and is one of the main areas of research for removal of metal toxicities. From this point of view we examined the anti-peroxidative role at different doses (250 and 500 mg/kg body weight) of different solvent extract (aqueous, methanol and petroleum ether) in chromium- induced oxidative damage in liver and lungs mitochondria. Results demonstrate a significant increase in the level of MDA, conjugated dienes and NO production associated with antioxidant (GSH, GSSG, GPx, GR, G-S-T, SOD and CAT) depletion in liver and lungs mitochondria in chromium treated rats. Interestingly, after supplementation with different solvents, it was observed that methanol and aqueous extract play a crucial role at the dose of AP<sub>500</sub> (500 mg/kg body weight) to prevent chromium induced oxidative stress in liver and lungs mitochondria.

From the above findings it was aimed to observe protective efficacy of hydro-methanol solvent extract of *Andrographis paniculata* Nees in different ratio (70:30, 60:40; 50:50; 40:60) at a dose of 500 mg/kg body weight. From the present research it has been noticed that particularly (60:40) mixed hydro-methanol solvent extract of *Andrographis paniculata* has an important role than other ratio in the maintenance of oxidative equilibrium against chromium-induced toxicity in liver and lungs mitochondria.

Therefore, the objective of this study was an attempt to reduce the effects of Cr-induced cytotoxicity by using the most potent mixed hydro-methanol solvent extract in the ratio of (60:40) of *Andrographis paniculata in vivo* in terms of certain structural and functional change of plasma membrane, mitochondrial electron transport chain (Mito-ETC) complexes, expression of certain cytokines, apoptotic

signalling pathway and histological status. Present observation noted that structural and functional alterations of the liver and lungs plasma membrane and the activities of Mitochondrial ETC –Complex I, II and III were counteracted by the hydro-methanol (60:40) extract of *Andrographis paniculata* supplementation. On the other hand, hydro-methanol (60:40) mixed solvent extract effectively protects the lymphocytes from chromium-induced cytotoxicity, pro and anti- apoptotic markers. Besides this, hydro-methanol (60:40) mixed solvent extract supplementation has a potent role to protect the hepatic and alveolar damage.

Objective of the present research was isolation, identification and quantification of andrographolide from hydro-methanol (60:40) mixed solvent extract of *Andrographis paniculata* Nees by using HPTLC, FTIR and HPLC to obtain andrographolide (ANDRO). In this investigation, most potent compound andrographolide (ANDRO) is identified and quantified from the mixed hydro-methanol (60:40) solvent extract of *Andrographis paniculata* by using the standard ANDRO.

From this study it may be concluded that proper mixed solvent extract of *Andrographis paniculata* Nees may be more potent as a natural agent containing active substances for the effective management of chromium induced toxicity and also related disorders in human beings.

**Keywords:** Hexavalent chromium, *Andrographis paniculata* Nees, Oxidative stress, Anti-oxidant enzymes, Solvent extract, Liver and lungs, Mitochondria, ANDRO (Andrographolide), Male albino rats.