Short communication

Effect of methyl isocyanate (MIC) on rat erythrocytes

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Abstract. Changes in surface morphology of rat erythrocytes were studied by scanning electron microscopy after a single and repeated exposure of methyl isocyanate under static conditions. Marked morphological changes (echinocytes and spherocytes) were observed, followed by an increase in osmotic fragility of the erythrocyte membrane. The activity of the membrane bound enzyme adenosine triphosphatase (Na+, K+, Mg++) was inhibited.

Key words: Methyl isocyanate – Scanning electron microscopy – Osmotic fragility – Erythrocytes – ATPase

Introduction

Epidemiological and experimental studies on methyl isocyanate toxicity following inhalation exposure were reported earlier from our center (Srivastava et al. 1988). These studies highlighted the changes in erythrocytes, total and differential leucocyte count, hemoglobin percentage, packed cell volume and erythrocyte sedimentation rate in human population exposed to toxic gases (Srivastava et al. 1988).

An increase in hemoglobin and hematocrit values was also observed under in vitro conditions in human, rats and guinea pigs (Troup et al. 1987). Alteration in the electrophoretic mobility of the hemoglobin molecule was also observed under in vivo conditions (Troup et al. 1987; Gupta et al. 1988). The present investigation was planned in order to explore the morphological and biochemical changes in the erythrocytes of MIC-exposed animals.

Materials and methods

Animals. Adult male Wistar rats (average body weight 150–180 g) of the ITRC colony maintained under standard conditions of husbandry and acclimatized for 7 days prior to exposure were used in the present study.

Results and discussion

The effect of different exposures of MIC (single and repeated exposures) on surface morphology of rat erythro-
Fig. 1. Picture of erythrocytes (control) showing typical discocyte as viewed by scanning electron microscopy magnification. 2500 ×

Fig. 2. Picture of erythrocytes after 7 days of single exposure of MIC (3.2 mg/l, 1420 ppm for 8 min) showing distortion in cells as viewed by scanning electron microscopy magnification. 2500 ×

Fig. 3. Picture of erythrocytes treated with MIC repeated exposure (0.32 mg/l, 142 ppm daily for 8 min × 10 days). After 10 days, showing different stages of echinocytes and spherocytes as viewed by scanning electron microscopy magnification. 2500 ×

Fig. 4. Picture of erythrocytes treated with MIC repeated exposure (0.32 mg/l, 142 ppm daily for 8 min × 15 days). After 15 days, showing distortion and deformity in cells as viewed by scanning electron microscopy magnification. 2500 ×

Fig. 5. Osmotic fragility curve after MIC exposure in rats in vivo

Our study showed that methyl isocyanate produced marked morphological changes in rat erythrocytes as observed by...