

ABSTRACT

This diploma work investigates the influence of thermal insulation at residential buildings on the concentration of CO₂ (carbon dioxide) in indoor environment. The studied area is a housing estate of panel buildings (flats) in Sezimovo Ústí city. The present work notices a positive impact of thermal insulation on energy demands of buildings and it is mainly saving consumed heat energy which is also connected with emission lowering of carbon dioxide emissions. The main problem which is solved in the work is that total insulation is usually done without any ventilation solution. It means that it has later a negative impact on indoor environment/air quality in flats. The main part of this work presents measurements of indoor air quality - CO₂ concentration, air change rate, temperature and relative humidity in an insulated (with plastic windows) and a non-insulated (with the original wooden windows) flats. The measurement lasted for three days in selected pairs of flats – with plastic and wooden windows. The measurement took place in bedrooms because the behaviour of residents of households was very similar during their sleep. The air change rate was then calculated from CO₂ concentration decay during period of 3 hours without residents. The main aim is to quantify these differences. The conclusion of this work is that plastic windows has a statistically significant effect on indoor air quality – lower air change rate, higher CO₂ concentration, higher temperature and relative humidity. The average CO₂ concentration was on average 91 % higher in flats with plastic windows than in flats with wooden windows. The recommended CO₂ concentration 1500 ppm was exceeded in all flats with plastic windows and in 59 % of flats with wooden windows. The concentration 3000 ppm was even exceeded in 9 % of flats with plastic windows. The air change rate ranges between 0,03 – 0,13 h⁻¹ in flats with plastic windows and between 0,21 – 0,50 h⁻¹ in flats with wooden windows. The average relative humidity was between 41,7 – 69,5 % in flats with plastic windows and between 29,8 – 56,1 % in flats with wooden windows. The average indoor temperature was between 19,4 – 24,7 °C in flats with plastic windows and between 14,7 – 22,3 °C in flats with wooden windows. This work also includes a survey on the quality of the indoor environment and case study about impact of microventilation on the CO₂ concentration and air change rate. The microventilation mode statistically significantly lowered CO₂ concentration in bedrooms and increased air change rate than in bedrooms with fully closed windows. The AER was on average 6x higher than with fully closed plastic windows.

Key words: CO₂ (carbon dioxide), building insulation, air change rate, intensity of ventilation, indoor environment, indoor air, indoor air quality, indoor environment quality, indoor conditions, environment