5. Conclusion

RedCubic, RedRhombo, and Blue were prepared by mixing small amount of $K_3[Cr(C_2O_4)_3]\cdot 3H_2O$ with $K_3[Al(C_2O_4)_3]\cdot 3H_2O$ and NaCl at room temperature. The three complexes were readily soluble in water. The crystal structure of RedRhombo could be solved while the structure of RedCubic and Blue could not be solved. The substitution of Cr^{3+} in $Al(C_2O_4)^{3-}$ yielded the complex $K_{18}\{K[Al_{0.97}Cr_{0.03}(C_2O_4)_3]_6\}Cl.18H_2O$ (RedRhombo) which contained 3% of chromium. The RedRhombo exhibits a rhombohedral cell with space group $R\bar{3}$. R and $Rw2$ are 0.0456 and 0.1235 for 2595 observed reflections. The RedRhombo consists of 18 atom of K and one Cl counterions. UV-Visible was used to confirm d-d transition of Cr^{3+} (d^3) as three bands (298, 420, and 572 nm) were observed. Oxalate ligand exhibits one intense band at 298 nm which can be assigned to the $\pi \rightarrow \pi^*$ electronic transitions. The d-d transition of Cr^{3+} expected to be from the $^4A_2$ ground state to the $^4T_2$(572 nm) and $^4T_1$(420 nm) excited states (spin allowed) and to the ^2E, $^2T_1$, $^2T_2$(698 nm) excited states (spin forbidden). RedCubic and RedRhombo show a color change under different light sources which are similar to that observed in the gemstone alexandrite. Infrared spectroscopy was used to confirm the mode of vibrations of the oxalate ligands in the free state compared with that in the complexes. The C=O stretching of RedCubic, RedRhombo, and Blue show intense bands in the range 1723-1675 cm^{-1} whereas the C—O stretching modes show intense bands in the range 1408-1271 cm^{-1}. The frequencies of the M—O stretching modes occur in the region 586-473 cm^{-1} and they show nearly Al—O stretching because they have 97 percent of aluminium and 3 percent of chromium in RedRhombo. The results of TGA analysis of RedCubic, RedRhombo, and Blue indicated that RedCubic lost 16.10%, RedRhombo 11.08%, and Blue 10.15% of weight in the range from room temperature to about 100°C which agree with the results of DSC showing endothermic peak about 100°C assigned to the loss of water molecules in the structure.