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THE EFFECT OF MOISTURE CONTENT ON ANGLE OF INTERNAL FRICTION OF TWO WHEAT VARIETIES

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INTRODUCTION: The friction properties of granular materials play an important role in the determination of specifications for designing of equipment and machines such as hoppers, transporters, driers and silos. Among cereals, wheat is the most and basic important human food is considered. According to the FAO statistics, wheat production in Iran in 2011, is 13.5 million tons. In a research, the angle of repose and internal friction coefficient were determined for three common wheat varieties (Sardary, Gaspard and Saysoter) at four moisture contents (12, 15, 18, 21 w.b.%) with four contact surfaces (black, mild, aluminum and galvanized sheets). The results showed that the effects of grain moisture content and variety were significant for the internal friction coefficient at 1% level (Askari Asli-Ardeh, and Rozegar, 2009). In a study, angle of external friction of two rice varieties with moisture content of 10% on galvanized sheet were determined (Varnamkhasti *et al.*, 2008). In other study, the relationship between moisture content and external friction of millet seeds were studied. The results showed that the angle of repose changed between 34.5 to 48.5 (Baryeh, □□□□□□ In this study, the effect of grain moisture levels (12 , 15 and 20% dry basis) and two varieties of wheat (Durum and Ghods) on the angle of internal friction of wheat was investigated.

MATERIALS AND METHODS: To determine the angle of internal friction, a load cell and two cylinders that made PVC with diameter of 100 mm and height of 50 mm was used. At first, the cylinders were put together so that they form a single cylinder. Then, the samples were placed separately into the cylinder. The upper cylinder was connected to load cell hook with a thread and then was pulled by the load cell until it begins to move. At this time, the force value was read. This shear force is equal to the friction force between grains that is shown with μ and calculate with equation (1): $\mu = F/N$ (1) where: F is shear force and N is weight of wheat in upper cylinder. To obtain the angle of internal friction (Ø), equation (2) was used: $Ø = tg^{-1}\mu$ (2). Data were analyzed in the form of factorial experiment in completely randomized design with five replicates by SPSS software version 18 comparison of means was done by Duncan's multiple range test.

RESULTS AND DISCUSSION: The results showed that the main effect of moisture content and interaction effect of moisture content and variety on the angle of internal friction is significant at 1% level but main effect of variety is non-significant. This is due to the different angle of internal friction that increased with moisture content of wheat grains. 12% and 15% moisture content were placed in a group and 20% was placed in other group. The angle of internal friction increased linearly with increasing moisture content for two varieties. The equation (3) and (4) showed the relationship between angle of internal friction and moisture content for Durum and Ghods varieties, respectively. Where MC is moisture content.

$Ø = 0.485MC+21.47$ $R^2=0.998$ (3)

$Ø = 1.693MC+1.715$ $R^2=0.991$ (4)

Keywords: Angle of Internal Friction, Moisture Content, Wheat

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