Title Gas concentration in the interstitial atmosphere of a wheat silo-bag. Part II: Model sensitivity and effect of grain storage conditions

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Citation Journal of Stored Products Research,Volume 47, Issue 4, October 2011, Pages 276-283

Keywords Silo-bags; Hermetic storage; Modified atmosphere; Wheat; Mathematical modelling

Abstract

A lumped capacitance model was applied to simulate the change in gas concentration in a wheat silo-bag. The sensitivity of the solution to a given model respiration rate and permeability (degree of gas-tightness of the silo-bag) was examined. Results showed that gas concentration is more sensitive to changes in respiration rate than to permeability of the plastic film. Considerable changes occur in gas concentration in a damaged silo-bag. The definition of an effective permeability to account for gas transfer through holes and plastic film allowed the examination of the effect of different holes configurations (number and size of perforations) on the evolution of gas concentration.

The influence of grain storage conditions on the evolution of gas concentration was investigated. The model was run for initial grain temperatures of 20, 25, 30 and 40C and MC in the range (12–16% w.b) and climatic conditions of the South East of Buenos Aires province, Argentina.

When dry grain (12–13% w.b) is stored, O_2 level remained above 12% and CO_2 level below 7%. For wet grain (15–16% w.b), CO_2 level was in the range 14–16% after six month storage. The simulations showed that for wet grain anaerobic conditions may be achieved within two weeks to three months of storage, depending on the grain initial temperature. Estimated mean DML for all the storage conditions remained always below 0.04%, the critical limit for safe storage of wheat that will be used for seeds.