The study of sorption Isotherms for varied temperatures of Cocoyam

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Abstract

The shelf life of materials is an essential attribute to examine since exposure to certain processes and environmental circumstances can cause their physicochemical qualities to deteriorate. As a consequence, the sorption isotherm and physicochemical characteristics of solid cocoyam (size: 95 microns) were investigated in order to determine its appropriateness for use in food systems and storage stability. For varying temperatures and relative humidities, the static gravimetric technique was used. While the sorption isotherm curves produced demonstrated typical type II isotherms, the equilibrium moisture content revealed variations in the quantities of moisture adsorbed. Moisture content, crude protein, fibre, fat, lipid, and ash, as well as carbohydrate content, were all measured chemically. The water absorption capacity, viscosity, and gelatinization temperature were also studied as physical characteristics. After fitting their experimental data with nonlinear regression, the GAB and BET models were shown to adequately represent the data. According to the sorption isotherms study, relative humidity in the range of 65-97 percent would be optimum for storing dry solids in moisture-tight packaging materials. For the BET and GAB models, monolayer moisture content of dried cocoyam varied from 0.018192- 0.028366g/g dry solid and 0.02156-0.028922g/g dry solid, respectively. These figures indicate that storage stability is greater at lower ambient temperatures. According to the findings of this study, cocoyam will last longer when stored at lower temperatures and relative humidity.

The moisture content of stored agricultural goods is generally affected by the environment's temperature and relative humidity. Various biological processes that might result in bio-degradation are supported by equilibrium relative humidity (ERH) or water activity (aw). (Oluwamukomi et al., 2007; Rockland and Nishi, 1980). The impacts of dynamic water flow during crop or crop product storage necessitate close attention for optimal storage characteristics. When harvested, plantain (Musa paradisiacal), a tropical fruit crop, has a high carbohydrate content. Matured fruits have an average moisture content of 61% and ripen quickly after harvest, making long-term preservation in their natural condition problematic (Okunola and Igbeka, 2007). Unripe plantains, on the other hand, are peeled, sun dried, and ground into flour for long-term preservation. Whereas, cocoyam (Cococasia esculenta) is a high-potential root crop commonly produced in Nigeria. It is a good source of calories and is high in starch but poor in protein and oil; and it accounts for a large amount of root crop output in the tropics (F.A.O.1981). When newly picked, it has a high moisture level of around 55%. The crop does not have long-term storage characteristics in its natural condition until it is processed into chips, sun dried, and ground into flour. Plantain and cocoyam's high moisture content renders biological degradation by microbial activity unavoidable in their natural condition. To enhance shelf life and storage stability, the condition of adsorbed water, a measure of the physical, chemical, and microbiological stability of biological materials during storage, is also important (Labuza, 1968, Chirife and Buera, 1994). According to Labuza (1980), lowering the moisture content to a safe level reduces microorganism metabolic activity and the inherent temperature during storage. aw is thought to be more closely connected to a food's physical, chemical, and biological characteristics than its total moisture content or biological growth (Staudt et al., 2013). The proportion of ERH is referred to as aw, which is a similar analogical word. The link between aw and a food's moisture content is crucial for forecasting quality stability during drying, shelf life storage, and the selection of appropriate packing materials, as well as being one of the most significant control factors in food preservation technology (Sun, 1999; McMinn and Magee, 1999). Specific changes in colour, fragrance, flavour, texture, stability, and acceptability of raw and processed food items have been linked to a very small aw range, according to Labuza (1980). Chemical moieties that impact the characteristics of biological products have been discovered as being influenced by their environment's attraction for water molecules as well as conflicting influences from nearby hydrophilic or hydrophobic chemical groups. The intrinsic shelf life properties of a product are influenced by its water sorption characteristics, which govern how long it may be safely stored (Rockland and Nishi, 1980; Ajisegeri and Sopade, 1990; Okunola and Igbeka 2007; Raji and Ojediran, 2011). Biological, bio-chemical enzyme triggered reaction, microbiological, and physiological kinds of crop losses have been recognised as being aided by moisture during storage (Labuza, 1968; F.A.O.1981; Moreria et al., 2010). Quality Control and Food Science www.iiste.org Vol.43, 2015 8 ISSN 2224-6088 (Paper) ISSN 2225-0557 (Online) The behaviour of agricultural goods during

storage or storage stimulation has been studied using moisture sorption isotherms (MSI), a connection between aw and the equilibrium moisture content (EMC) in a substance at a constant temperature.

However, in their study of the moisture content and ERH of Jaggery (a concentrated sugar product), Verma and Maharaji (1990) discovered that its hygroscopicity increases with increasing temperature, which is consistent with earlier findings (Iglesias and Chirife, 1978) on sugar and high sugar containing foods. One of the most significant factors for forecasting technological performance and product quality in foods during storage is water sorption (Chirife and Buera, 1994; Vilades et. al., 1995). It's crucial to understand the sorption properties of these dried agricultural products since they're vital in food formulation and storage stability. As a result, comparing the hygroscopic behaviour of cocoyam and plantain at the current ambient temperature in Nigeria's south west is of interest. The temperature of the experiment was set between 25 and 45 degrees Celsius to replicate the fluctuation in ambient temperature that occurs during storage in the humid environment of Nigeria's south west.

Biography

Sunday Iji, has completed his B.Eng in Chemical Engineering from Federal University of Technology, Minna, Niger State and is about to round up his Masters Studies in University of Uyo, Akwa Ibom State, Nigeria. His Masters study is still in the field of Chemical Engineering. He is 32years and presently the Director of Entrepreneurship Development Centre at Federal Polytechnic Ukana, Akwa Ibom State, which is a reputable tertiary institution in Nigeria. He is writing papers which are yet to published in reputed journals.

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