Identification of Sulphur Added Copra Using Drying Process

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Abstract: The characteristics of fruits are varying based on moisture content. The sulphur is fumigated to copra as preservative. As per WHO report the 65% children are suffered with asthmatic are sensitive and 75% of children are changes in behavior. It is difficult to identify sulphur added copra manually. In this proposed work drying process is used to identify the sulphur content of copra by comparative analysis with normal copra. The drying process leads to change in features like shape, colour and texture content of copra. The copra is dried in tray drier at 60 ºC for a regular interval of time. The image is capture at regular interval of time, GLCM features are extracted and compared between sulphur added and normal copra. The results are analyzed at different levels.

Keywords: Copra, Sulphur content, Feature Extraction from GLCM.

1. Introduction

The feature measurement is important characteristic of classification. The normal feature extraction is differing from vision based feature extraction in moisture content measurement. The measurement of textural properties is based on moisture content by drying process of fruits. The moisture content of fruit varies according to the drying condition. Normally the sample is dried under certain condition and image is taken at regular interval of drying time. The textural and shape properties are measured for image taken at regular interval of time. The feature extracted is gradually decreased by increasing drying time. Vision system produces an efficient way to determine the moisture content and to do classification. The machine vision system is a technology for computer-aided image processing in real time. The increasing capacities of vision system tend the advancement in image processing classification [1]. The recognition of apparent characteristic of material such as shape and color is obtained by vision system. It is inexpensive and new advanced trends in image processing [2]. The Sulphur fumigated content is measured using different image methodologies. The sulphur patch is segmented and area measurement is made to find the percentage of sulphur fumigated [3]. Computer vision system is used to analyze moisture content in shrimp. Color models such as RGB, L*A*B* transformation are carried out to extract the features. Artificial Neural Network and Multiple Linear Regression are applied for correlating the color features [4]. The vision based features measured to categories the different stages of raisin drying process. Shape color and texture features are used to differentiate the different stages of drying and neural network is used for classification [5], [7]. The feature like size and textures are used to find the shrinkage and porosity of fruits like apple, banana, pine apple and mangoes. Shrinkage of potatoes during drying process is measured using size and texture features [6], [8], [9]. Neural Network and partial least square regression methods were proposed to analyze correlation between color and moisture content of beef joints [10]. Rice drying process and de-hydration of apple discs was analyzed by using color models [11], [12]. Multi spectral imaging techniques and support vector machine classification methods are used to sort the tea.
categories by using texture features [13]. The green plane from RGB and HSI color base are extracted continuously to monitor drying process using computer vision systems [17].

The online estimation i.e., the relation between area shrinkage and moisture content was used for online estimation [14]. This paper is structure as follows. Section II discuss about the machine vision system. Section III discuss about the segmentation. Section IV discuss about Drying Process. Section V discuss about Texture Feature extraction of dried material. Section VI discuss about Results & Discussion.

2. Segmentation
The segmentation is done to remove the background image from the original image. Thus results were in binary image and the original image is superimposed on the image. The copra image is converted into binary form of image. The intensity ‘1’ in binary image represent the copra and intensity ‘0’ in binary image represent the background. The original image is superimposed on ‘1’ in binary image [16], [18]. The white part of copra is segmented from background. The segmentation is carried out for copra with shell and without shell is shown in Fig 1 and 2.

Figure.1 Process Methodology
2.1 Related work: The clustering technique of k-means is used to differentiate at various levels against copra. To calculate the percentage of sulphur found in copra, the segmented patch region is assessed. Three levels (low sulphur added area, medium sulphur added area and high sulphur added zone) are divided into the percentage of sulphur over copra. In classifying sulphur added copra at various stages, the K-Nearest Neighbour category is also used. The proposed algorithm categorises copra added to sulphur at three distinct levels with 86 percent precision. [17] [20].

The area of interest is acquired by extracting the brown shell of the copra (that is, only white layers are separated). Initially, the colour and shapes are extracted to detect the presence of sulphur after discovering ROI. The Sulphur patch present in the copra is segmented by clustering once the algorithm senses the presence of sulphur k-means. The percentage of sulphur present in the copra should be determined by the white pixel. The KNN Classifier is used to calculate the precision of fumigated sulphur and regular copra.

3. Drying Process
The drying process includes the exposure of high content material in oven or tray drier. The drying processes were exposed to physical and chemical changes in the product. The quality values were changed by amount of water content. The water content is reduced over dryness of product. The dryness results in shrinkages of product which was used to classify the diseased product. The decreasing moisture content of apple decreased an effective influence on density of them. The morphological features were used in grading and sorting of object. Changes in shape and size during the drying process alter the textural properties of an item. The textural properties of shrinkage were measured at regular interval of time. The copra is dried in tray drier at regular interval of time. The copra is dried at 60°C. The sample is taken at regular 2 hours interval time and the moisture content is measured. The change in textural and color changing properties are measured by image processing method. The change in properties of copra with drying time for both sulphur fumigated and normal
copra is observed. The moisture content of coconut is varied according to drying condition. After 6 hours of dryness, the copra is removed from the shell. The copra lost all moisture content after attains the equilibrium moisture content after 12 hours of drying. The dryness of copra at different stages is shown in Fig.3.

![Figure 3](image1)

**Figure 3** The Changes of a copra Sample as a Function of Drying Time. (a) Initial stage of coconut. (b) dried coconut after 2 hours (c) after 4 hours (d) after 6 hours (e) shell removal copra after 8 hours (f) shell removal copra after 10 hours.

4. **GLCM Features**

The texture function was evaluated for fruit shrinkage due to changes in the appearance of fruit dehydration. In drying, the association between shrinkage and moisture content and color intensity was observed. The shrinkage area, moisture content, color intensity was observed. In addition, moisture content plays a crucial role in prediction of food quality apart from textural and shape properties. The shape feature extraction measures

The texture feature extraction measures

- **Entropy**: Disorder of an image.
  \[ \text{Entropy} = \sum_{i=0}^{N-1} \sum_{j=0}^{N-1} p(i,j) \log p(i,j) \] (1)

- **Energy**: Measurement of textural uniformity of image.
  \[ \text{Energy} = \sum_{i=0}^{N-1} \sum_{j=0}^{N-1} p(i,j)^2 \] (2)
  
- **Contrast**: It is also called inertia. It measures the local variation in image.
  \[ \text{Contrast} = \sum_{i=0}^{N-1} \sum_{j=0}^{N-1} p(i,j) (i-j)^2 \] (3)

- **Correlation**: The correlation between the elements of matrix.
- **Inverse difference moment**: It measures the image homogeneity.

The texture feature changes for sulphur fumigated copra are measured.
Table 1: GLCM Features Of Sulphur Fumigated Copra

| Features     | 2 Hrs   | 4 Hrs   | 6 Hrs   | 8 Hrs   | 12 Hrs  |
|--------------|---------|---------|---------|---------|---------|
| Contrast     | 0.5149  | 0.2914  | 0.1951  | 0.0785  | 0.0583  |
| Correlation  | 0.9930  | 0.9874  | 0.9715  | 0.8952  | 0.8456  |
| Energy       | 0.5589  | 0.5745  | 0.6123  | 0.9452  | 1.3546  |
| Homogeneity  | 0.9973  | 0.9954  | 0.9469  | 0.9123  | 0.8945  |
| Entropy      | 7.415   | 7.156   | 6.945   | 6.738   | 6.542   |
| Mean         | 98.45   | 92.45   | 90.07   | 82.062  | 75.021  |
| Standard Deviation | 87.03  | 73.78   | 62.7    | 49      | 45.5    |
| Median       | 216     | 202     | 195     | 187     | 179     |

Table 2: GLCM Features of Normal Copra

| Features     | 2 Hrs   | 4 Hrs   | 6 Hrs   | 8 Hrs   | 12 Hrs  |
|--------------|---------|---------|---------|---------|---------|
| Contrast     | 0.0124  | 0.0128  | 0.0121  | 0.0125  | 0.0130  |
| Correlation  | 0.9830  | 0.9951  | 0.9733  | 0.9234  | 0.9358  |
| Energy       | 0.5146  | 0.2180  | 0.3154  | 0.2549  | 0.2415  |
| Homogeneity  | 0.9456  | 0.9915  | 0.9918  | 0.9920  | 0.9915  |
| Entropy      | 7.236   | 7.485   | 7.865   | 7.123   | 7.154   |
| Mean         | 116.75  | 112.58  | 98.5    | 92.56   | 89.5    |
| Standard Deviation | 93.5   | 89.6    | 75.4    | 62.8    | 55.8    |
| Median       | 188     | 186     | 172     | 160.5   | 155.2   |

5. Results & Discussion
The copra is maintained under drying process. Moisture content decreased for every 2 hours. The contrast of sulphur fumigated copra and normal copra are measured and shown in Fig.5. The sulphur fumigated copra contrast values are decaying with time. Normal copra does not change with time.
The Correlation of sulphur added and normal copra were analysed. The values of sulphur fumigated copra are slightly decreasing compared to normal copra is shown in Fig 6.

The energy of sulphur fumigated copra is increased with time compared to normal copra. This feature is mainly used to identify the sulphur fumigated copra compared with normal copra is shown in Fig 7.

Homogeneity and entropy value are measured and analysed that values are slightly varying compared with normal copra is shown in Fig.8 & Fig.9.
Mean, median and standard deviation values are decreased with both sulphur added and normal copra and shown in the Fig 10,11&12.
Fig. 4: The variation of M.C during the time of drying. The energy value of sulphur copra increases with drying time and other GLCM features Contrast, Correlation, Homogeneity, entropy decreases with drying time.

6. Conclusion
In this paper we reviewed about identification of sulphur added copra using drying process. The changes in textural properties during drying time are measured and analysed using GLCM features. The textural and statistical property decreased at different drying condition is measured. The energy of sulphur fumigated copra increased with time and all other features of GLCM decreased with time when compared to normal copra features. By using energy values the sulphur added copra is identified. Future work is to extract the colour and shape properties and to measure the sulphur content by using various classification methods.

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