Design Electronic Tongue for Amylose Content in Corn using Virtual Instrumentation

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Abstract: **Nowadays people are dietary careful about food contains and its quality parameters. In case corn amylose contents is good quality parameter. Amylose contents decide digestion time which predicts the absorption of glucose in blood. So, diabetic patients are suggested to use high amylose content corn. Detection of amylose contents in corn needs attention as a part of dietary as well as selection for corn for a typical application. Qualitative analysis of corn to detect amylose contents becomes motivation. Many dierent methods are used for checking amylose contents like NIR spectroscopy, colorimetry, and latest cyclic voltammetry. In amylose-iodine colorimetry, a standard color chart was used instead of a spectrophotometer to successfully classify a wide range of cultivars with known and unknown amylose content. Near-IR spectroscopy can also be used to measure the amylose contents. As an alternative method, voltametric electronic tongue can be used for classification of amylose contents in corn. All current methods/techniques of amylose detection require a typical experimental setup. Amylose content is predicted corresponding to output values of setup. To overcome the requirement of experimental setup, a virtual instrumentation based (NILabVIEW) user interface is used for the prediction of amylose contents. The user interface provides a platform to compare results for different methods of checking. The graphs are plotted using the different experimental setups and comparing it with standard laboratory readings. The virtual instrumentation interface provides soft sensing of the amylose contents in absence of experimental set ups.**

Keywords: **Corn samples, Image processing, LabVIEW-vision.**

1. Introduction

Corn is one of the most important cereals in the agricultural sector. corn is consumed and produced in a huge quantity worldwide. It is a cereal with a high nutritious content which is required for human health benefit. Assessment of rice quality has become necessary to maintain the market value. corn quality depends upon physical and chemical characteristics. Physical quality assessment of corn mainly depends on its size, amylase percentage, broken grains, and colour. Previously amylose evaluation was carried out by passing the light and the measurement was dependent upon the absorption and refection of light through the corn grains. Photographic enlarger, stereo zoom microscope and magnifying glass were also used for the estimation. The measurement done by such inspectors includes inaccuracy. Such manual measurements are badly affected by the factors such as inexperienced inspectors, non-repeatability and sometimes it leads to the breakage of corn grains during handling. Recently machine vision technique has taken place of the manual measurement technique. Inaccuracy, non-repeatability, and breakage of grain problem have been overcome by using the image processing techniques. Amylose leads to the breakage of corn grain so it's necessary to evaluate the percentage of amylose present in corn grain. In this paper LabVIEW software is used as the programming tool for applying the image processing algorithms on the image of corn sample. This is the efficient and non-destructive technique. LabVIEW stands for "Laboratory Virtual Instrumentation Engineering Workbench". It has the feature of representing the programming dataflow in the graphical form. It has the GUI (Graphical User Interface) for controlling and measurement.

2. Proposed system

For the estimation of chalkiness percentage experiment set up is done. The hardware used in the experiment system is the NI 1742 smart camera, PC (Personal Computer), lens, power supply, Ethernet cable. As already mentioned LabVIEW software is used for proposing the image processing techniques.

1) NI 1742 Smart camera

NI 1742 consist of a 533 MHz PowerPC processor and works on a RTOS (Real time operating system). It has a 1/3 inch Sony ICX424AL CCD image sensor which acquires a VGA monochrome image having a resolution of 640×480 pixels. It also consists of features direct drive lighting controller to give power directly to third party lighting source and Quadrature encoder support. It works on 24VDC, 450mA power supply. It also has an SDRAM and Non-volatile program or data memory of 128MB along with the unlimited image storage using FTP or an Ethernet hard drive.

2) Labview

In this our experimentation system we are mainly focused on using vision module as we are working on the corn image. For the development of code we need few add-ons such as LabVIEW Real-Time Module, NI Vision Development Module, and Vision Acquisition Software. Real time module is required to embed the code on RT targets here our RT target is NI smart camera, this module enables the vi's developed to get

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embedded in the smart camera so that the images can be acquired in the real time. The NI Vision Acquisition software consists of the Measurement & Automation Explorer (MAX) configuration software and NI-IMAQ driver software.NI smart camera is configured using MAX and the required software's are also installed in the camera using it. IP address can also be assigned by using MAX along with the acquiring and saving the images. NI Vision Development Module has the feature of image acquisition, image processing and image analysis. All the major programming part is done by using this module and the results are analysed and displayed.
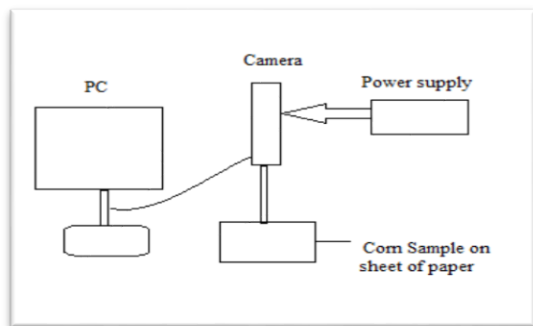

Fig. 1. Experimental set up

3) Proposed image processing method

Below is the flowchart and algorithm of the proposed system implemented for the assessment of amylose
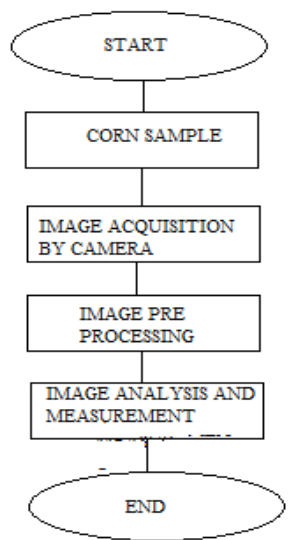
percentage in the corn sample.

Fig. 2. Flow chart of the system

B. Corn Sample

Sweet corn is taken as the sample for the amylose estimation which is one of the physical parameter of corn. The estimation is done on 20 corn grains. Sample is laid on the sample sheet randomly.

C. Image acquisition

The image of a corn sample for the inspection is acquired by using the smart camera NI 1742 (National Instrument smart camera) with Computer M0814-MP, 8 mm F1.4, Megapixel. The image can be captured by using the software modules NI Vision Automated Inspection express vi (Virtual Instrument). The corn grains are placed on the black sheet of paper. While capturing the image there should be a proper and equal distribution/illumination of light on the sample as the light plays an important role in capturing the clear and noise free image. The distance between the sample and the lens.
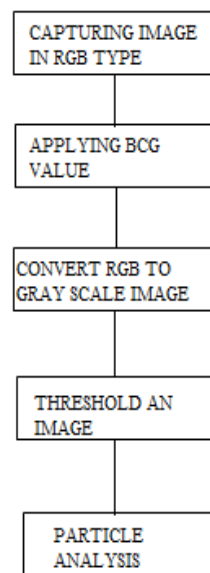

Fig. 3. Implemented algorithm for Amylose estimation

D. Pre-Processing an image

After acquiring an image the processing on the image is done to get the result. While acquiring an image sometimes the noise get added into it like pepper and salt noise due to the improper illumination of light. To eliminate all these disturbances, to analyze the sample and to carry out the various algorithms for the measurement purpose preprocessing should be done on the image. Following is the processing done on the image:

1) IMAQ create

It creates a temporary memory location for an image along with the NI Vision images in LabVIEW also the border can be created around an image. Unique name to the images can also be assigned by using this palette. Various image type can also be assigned to the image (Grayscale, Complex, RGB, HSL) so the output image is displayed as per the specified image type. Here firstly we have selected the image type as RGB (32 bits per pixel (red, green, blue,

2) IMAQ read file

This palette has an input named file path, in this we have to give the path of the image file, then it reads the image as per the path given and displays the same image as a output on the front panel as per the given image type. It reads an image of any

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format (JPEG, PNG, and BMP).

Fig. 4. Corn sample

3) IMAQ Color BCG Look up

By using this palette we can apply brightness, Contrast and Gamma correction to the image for all three colors i.e. (Red, Green, and Blue). The values for all the three parameters can be set as per our user need for these colors. By modifying the values of brightness contrast and gamma correction of the above three colors the background and rice particles gets estranged with respect to the different colors and also the chalkiness present in the rice becomes detectable easily. This algorithm can only be applied to the RGB image type so firstly we took the image type as RGB. We can clearly see the chalkiness present in the rice is in the blue color, the background and rice particles are separately visible due to the reddish color of background.

Fig. 5. Corn sample (RGB format)

4) IMAQ threshold

After converting the image into greyscale threshold is applied to the image. By applying threshold, the conversion takes place of a greyscale image into black and white and also the image gets divided into segments. This palette creates a binary image from a greyscale image so that the region of interest gets separated from the background. By applying thresholding on our given corn sample the Amylose present in the rice gets visible as holes. On the basis of this further analysis and measurement of the chalkiness percentage is done. The below shows the effect of thresholding on the corn sample.

Fig. 6. After setting RGB Value

E. Image Analysis and Measurement

1) IMAQ particle analysis

This palette is used for the analysis and measurement of an image. Particle measurement can be done in pixel as well as in real world measurement. The parameter to be estimated is given as the input from the array of measurement parameters requested for each particle. Firstly, we have calculated the area of corn grain by selecting the area as the measurement parameter. Secondly, we have calculated the white area by selecting the hole's area as the measurement parameter. From this we can do the estimation of the amylose from the whole sample and the percentage of amylose present in the sample.

3. Results and conclusion

Table 1
Percentage of amylose present in the corn sample

S. no.	Sample no.	Valuation through LabView (%)
1	Sample1	24.4
2	Sample 2	26.65
3	Sample 3	25.2
4	Sample 4	23

For corn amylose valuation we have considered the percentage of amlyose present in sample. The evaluation is carried out of using the image processing algorithm implemented in LabVIEW and the result are cross checked with the manual method by using Iodine test. From the above table we can estimate that amylose percentage of the more than 20%. Image processing using LabVIEW is a non-destructive technique for the evaluating the amylose percentage in the very efficient way as to compare manual method.

The number of total grain in the sample manual inspection consist of lots of inaccuracy as compare to this method. The processing time of algorithm is nearly of few ms in the LabVIEW, whereas manual method is time consuming as calculation are to to be carried out for estimating the amylose percentage. from the above information we can now calculation the amylose percentage present in the sample.

Amylose (%) = $\dfrac{\text{total number of white portion grains}}{\text{Total number of corn grains in the sample}}$ * 100

References

[1] Yuan jian, Yang Xiaorong, and Wang Zhaoci1, "Research on method for determination of amylose content in rice", Proceedings of the 7th International Worktng Conference on Stored-product Protection - Volume 2.

[2] HouZhesheng, Chen Xinyuand Yin Jinghup, Preparation of corn short amylose startch, Materials and Intelligent Manufacturing (ICNMIM)".

[3] Jyoti D. Bambole, K. A. Ghodinde, "Evaluation of chalkiness in basmati rice by virtual instrumentation,2015 International Conference on Smart Technologies and Management for Computing, Communication, Controls, Energy and Materials (ICSTM)".

[4] K V Santhosh, Pankaj Kumar Bhowmik, "Automated monitoring of bottle filling process Using LabVIEW", Proc. of the Intl. Conf. on Advances in Computer Electronics and Electrical Engineering, 2012.

[5] Changyun Fang, Xianqiao Hu, Chengxiao Sun, BinwuDuan, LihongXie, Ping Zhou, "Simultaneous Determination of Multi Rice Quality Parameters Using Image Analysis Method", Food Analytical Methods, vol. 8, no. 1, pp. 70-78, 2014.

[6] ISO 6647-1987 (E), Determination of amylose content in rice.

[7] Yasuhito Takeda Susumu Hizukuri Bienvenido O.Juliano, "Purification and structure of amylose from rice starch," Carbohydrate Research, vol. 148, no. 2, pp. 299-308, May 1986.

[8] Shyam Sunder Alariya, Sonia Sethi, Sakhsam Gupta and B. Lal Gupta, Amylase activity of a starch degrading bacteria isolated from soil," CODEN (USA) AASRC9.