

Research Article

Interpretation Of Physical Properties Like Crystallinity Of Maize Starch Powder Effectively By Foldscope.

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Abstract

Most foods are multi-component systems that contain complex mixtures of water, carbohydrates, proteins, lipids and numerous minor constituents. Starch is a macro-constituent of many foods, and its properties and interactions with other constituents are of interest to the food industry and for human nutrition. Starch is widely consumed by humans as an inexpensive and stable available carbohydrate source, and much work has been performed on the structure, functionality and applicability of starches. The paper-based Foldscope is an inexpensive and light-weight device, also utilizing a ball lens for magnification, as well as a battery-powered LED for illumination. In this Paper the foldscope studies different grades of maize starch powder, which were showed the different types of the crystal present in the starch powder. We used Pregel starch food grade powder & maize starch BP powder with water and glycerol. The result relieved that showed different types of the crystals present.

Keywords: Compound Microscope, Foldscope,

White Flour, Maize starch powder, Pregel powder, Glycerol, Water.

Introduction

A microscope is basically made of curved pieces of glass, called lenses, inside a tube. The lenses force light waves to bend as they pass through an object. As the light waves bend, they spread out, so the object appears much larger than it really. The simplest microscope is a magnifying glass. Made of just one convex lens (thicker in the center than at the edge), it causes rays of light coming in one side of the lens to bend, stretch and converge on a spot on the other side of the lens. Due to principles of geometry, this makes the image appear larger than it is. The magnification usually depends on how curved the lens is, as well as the distance between the lens and the object and the lens and your eye. More advanced microscopes, using a combination of different types of lenses, can see things as small as an atom.

A Foldscope is an optical microscope that developed by **Manu Prakash** and designed to cost less than US\$1 to build. The Foldscope weighs 8 grams and that provide magnification from 140X to 2,000X. Foldscope attach it to a smartphone with the help of magnet for the user to take pictures of the magnification. It is compact and light, especially when compared with conventional field microscopes.

Starch:

The basic chemical formula of the starch molecule is $(C_6H_{10}O_5)_n$. Starch is a polysaccharide (q.v.) comprising glucose monomers joined in α 1,4 linkages. The simplest form of starch is the linear polymer amylose; amylopectin is the branched form, amylose (a linear polymer of α -D-glucose units linked by α -1,4 glycosidic linkages) and amylopectin (a branched polymer of α -D-glucose units linked by α -1,4 and α -1,6 glycosidic linkages), representing approximately 98–99% of the dry weight

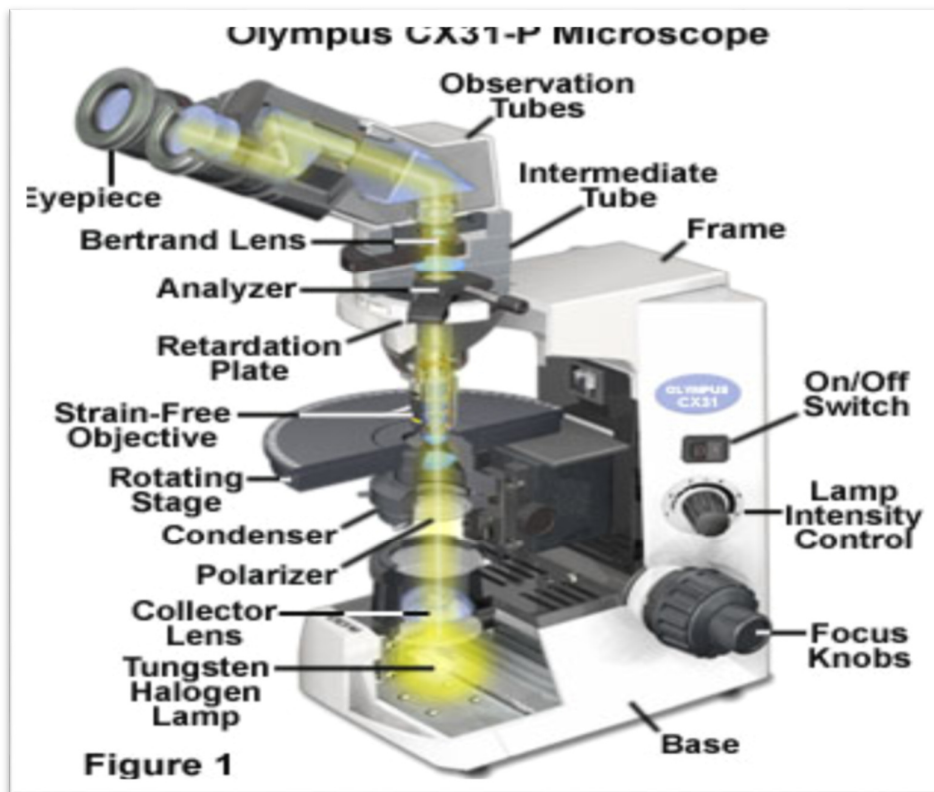


Figure1 : Compound microscope

Although conventional sources of starch, such as corn and potato, other sources with improved properties are becoming significant to allow simpler and more robust processes.

The main role of Pregel starch we manufacture is to increase the shelf life of frozen foods. It provides consistency to final products, acts as a texture stabilizer and gives a crisp coating to baked goods. Pregel starch is ideal for both hot and cold systems. It enhances the texture in cakes and cookies. Corn starch or maize starch is the starch derived from the corn (maize) grain. The maize grain contains, on average, about 61.50 to 77.40% starch (dry basis). Starch is fairly versatile and has a wide variety of uses. In food industries, starch is used to impart functional properties to processed food because it affects the physical characteristics of many foods.

Maize starch is a fine, powdery substance derived from the endosperm of the corn kernel. It is commonly used as a thickener in puddings, gravies, sauces and fruit compotes, and is gluten-free. The main botanical source of starch is maize,

accounting for about 80% of the world market. Maize starch is an important ingredient in the production of foodstuffs, and has been widely used as a thickener, stabilizer, colloidal gelling agent, water retention agent and as an adhesive. Corn /maize starch serves as an anti-caking and thickening agent in baking. The microscopically studied starch powder and reported to different types of the crystals present in the maize starch and pregel starch.

2. MATERIALS & METHODS:

a. Sample collection:

The maize starch BP & the Pregel starch (food grade) sample collected from M/S. Universal Starch Chem Allied Ltd. Dondaicha, Dhule.

b. Macroscopic Study:

The powder were studies for the macroscopic parameter like Colour, Odour, Test, Solubility, Texture.

c. Microscopic study of starch powder:

Powder was stained with water and observed under microscope & foldscope to determine the crystals. Powder was stained with Glycerol+Distilled Water and observed under microscope and foldscope to determine the crystals.

3. RESULT & DISCUSSION:

In the present study maize starch & pregel starch powder showed crystals carried out using glycerol & water under foldscope.

a. Macroscopic study:

The Starch powder were collected and checked

out for macroscopic parameter that is Colour, Odour, Test, Solubility, & Texture. (Table - 1)

b. Powder microscopy:

The White Flour powder, maize starch & pregel starch powder examined under a microscope, using $10\times$ magnification and using equal volumes of glycerol and water, it showed the presences of microscope angular polyhedral granules of irregular sizes with diameters ranging from about $2\ \mu\text{m}$ to about $23\ \mu\text{m}$ or as rounded or spherical granules and same

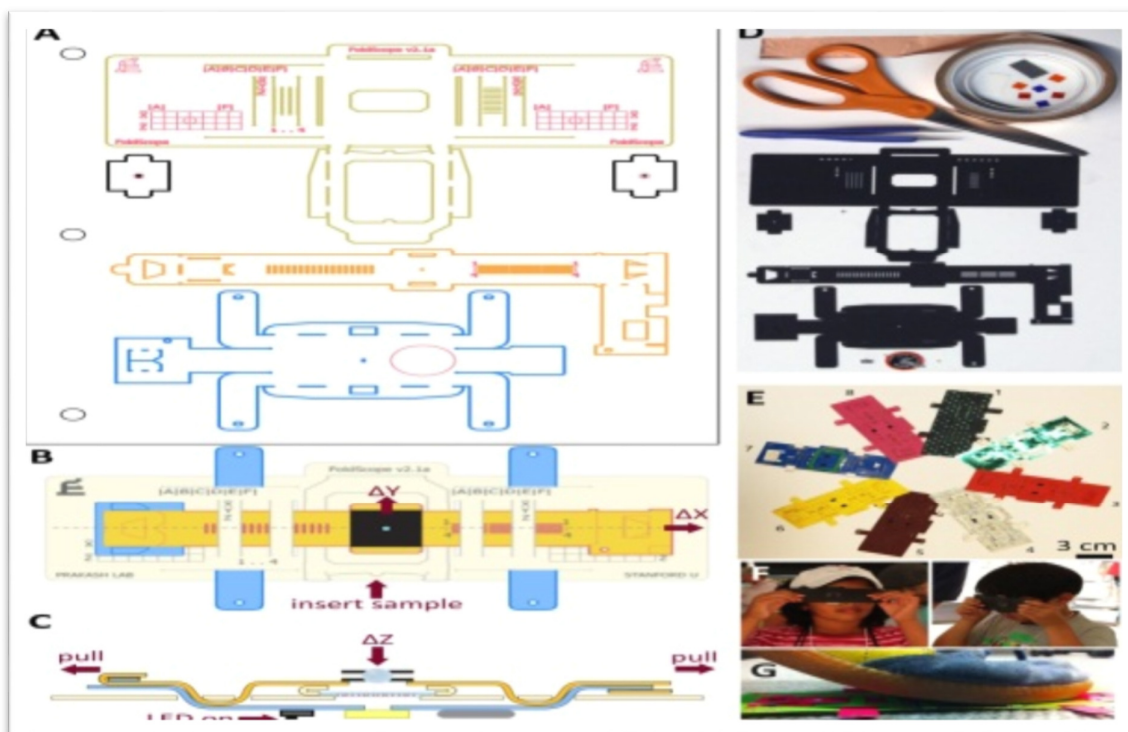


Figure 2. : Foldscope design, components and usage. (A) CAD layout of Foldscope paper components on an A4 sheet. (B) Schematic of an assembled Foldscope illustrating panning, and (C) cross-sectional view illustrating flexure-based focusing. (D) Foldscope components and tools used in the assembly, including Foldscope paper components, ball lens, button-cell battery, surface-mounted LED, switch, copper tape and polymeric filters. (E) Different modalities assembled from colored paper stock. (F) Novice users demonstrating the technique for using the Foldscope. (G) Demonstration of the field-rugged design, such as stomping under foot

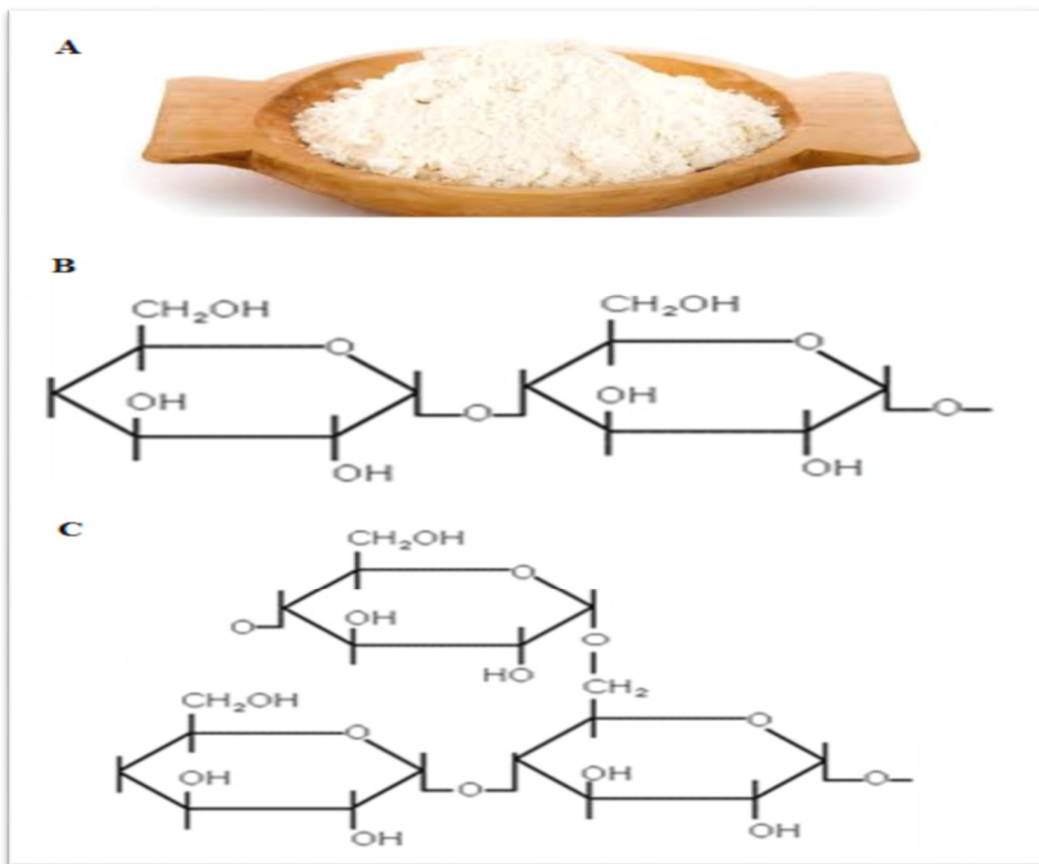


Figure 3: (A)Starch (B) Amylose (C)Amylopectin

showed under foldscopealso.see the images (Table no.3)

Table no.1: Macroscopic test of the Maize starch

Sr.no.	Test	Observation	Result
1	Texture	Smooth	Smooth
2	Color	White	White
3	Odor	odorless	odorless
4	Taste	tasteless	tasteless
5	Solubility	Insoluble in cold water.	Insoluble in cold water.

Table no.2: Macroscopic test of Pregel starch Powder:

Sr.no.	Test	Observation	Result
1	Texture	Smooth	Smooth
2	Color	White	White
3	Odor	odorless	odorless
4	Taste	tasteless	tasteless
5	Solubility	Insoluble in cold water.	Insoluble in cold water.

DISCUSSION:

The foldscope was easily handle, The following points are offered for consideration regarding the modest performance of this foldscope used for interpretation of physical properties like crystallinity of the powder, the image quality seems to be superior when Foldscope can be connected to a smartphone with the help of magnet for the user to take pictures of the magnification. We sought to

examine the maize starch powder under foldscope to examine different type of the crystals. The White flour powder and Maize starch powder carried out with Glycerol and Water The result was that White flour powder shows Amorphous and Maize starch powder shows crystalline in structure in foldscope.

CONCLUSION:

The compound microscope to take many precautions for the example Microscope should be kept at a dry place with ambient temperature, sliding and rotating part can be lubricated with fine machine oil, eyepiece lens, iris diaphragm should be free from dust etc. But foldscope had no any that precaution. It very easy to handle & not costly. Foldscopes are compact and light, especially when compared with conventional field microscopes, It is so affordable and can be used anywhere. It requires no external power, the foldscope that can fit in your pocket They are difficult to break. Since the application of this affordable foldscope to a different domain of microscopic study would help people to better understand the microscopic world around us including microorganisms and microstructures.

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Figure 4: Comparison of Maize starch powder and White Flour powder images

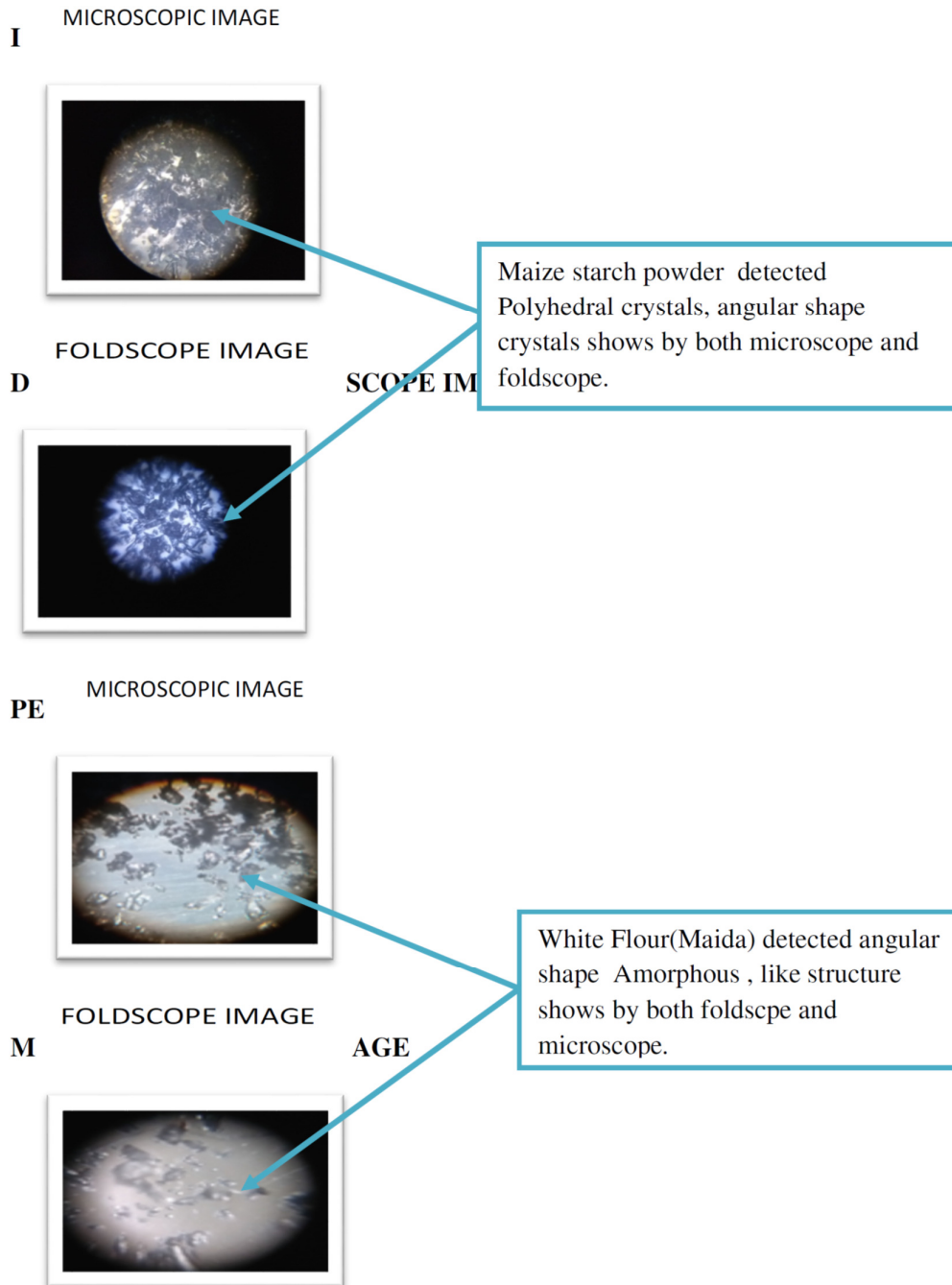
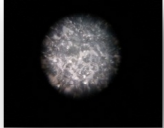
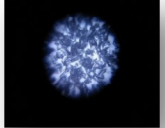
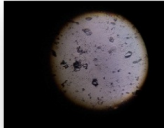

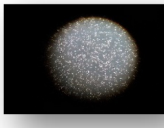
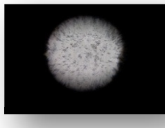
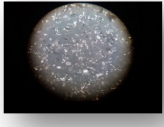

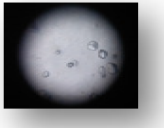



Table no. 3: Maize starch and pregelstarch Powder with Glycerol and Water both showed different crystals under microscope and Foldscope images showing below

Sr no.	Sample	Microscope	Foldscope
1	Maize starch powder		
2.	Maize starch powder +water		
3.	Maize starch powder+glycerol		
4.	Pregel starch powder		
5.	Pregel starch +water		
6.	Pregel starch +glycerol + water	