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# Determination and Study of Reducing and Non-reducing Sugar from Different Food Samples

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*Sugar is classified in two categories, reducing and non reducing sugar on the basis of free aldehydic and ketonic group . Reducing sugar contain free aldehydic group ketonic group and they reduce Fehling's solution & Tollen's Reagent. All monosaccharides are reducing sugar. Disaccharides may be reducing as well as non reducing . If the carbonyl groups of both the monosaccharide units in a diasaccharide are involved in linkage, the diasaccharides is non reducing i.e they cannot reduce Fehling solution & Tollen's reagent. On the other hand if one of the carbonyl group is free, the diasaccharides is reducing for eg:- sacrose. Sucrose is the most widely occurring diasaccharides . Sucrose is non reducing sugar . It indicates that the two hexoses must have joined through a glycosidic linkage between C-1 of glucose & C-2 of fructose . Reducing sugar can directly be titrated with a known amount of fehling solution which gives brick red colouration to the solution. This confirms the presence of free carbonyl group i.e. reducing whereas food samples containing non reducing sugar does not give this test. Fruit juice & sweet materials contains sugar. In the presence of reagents like Fehling A, Fehling B & Methylene Blue, reducing & non reducing sugar can be estimated.*

***Keywords:*** Reducing Sugar & Non-reducing Sugar Fehling solution A and Fehling Solution B.

## Introduction :

Sugar is classified in two categories, reducing and non reducing sugar on the basis of free aldehydic or ketonic group. Sugars are calssified as monosaccharides, oligosaccharides or polysaccharides. Monosaccharides containing aldehyde group are called aldoses while those containing ketonic group are called ketoses. Reducing sugar contain free aldehydic or ketonic group and they reduce Fehling's solution & Tollen's reagent. All monosaccharides are reducing sugar. Disaccharides may be reducing or non reducing. If the carbonyl groups of both the monosaccharide units in a disaccharide is non reducing i.e they can not reduce Fehling solution or Tollen's reagent, On the other hand if one of the carbonyl group is free, the disaccharides is reducing for eg: Sucrose. Sucrose is most widely occurring disaccharides. It is found in all photosynthetic plants. It is obtained commercially from sugarcane or sugar beet. Sucrose is non reducing sugar. It indicates that the two hexoses must have joined through a glycosidic linkage involving C-1 of glucose & C-2 of fructose.

## Priniciple of the Experiment :

Reducing sugar can directly be titrated with a known amount of Fehling solution which gives brick red colouration to the solution. This confirms the presence of free carbonyl group i.e reducing sugar whereas food samples containing non reducing sugar does not give this test. It is hydrolysed by HCl, neutralized & then titrated. The reaction is rapid in alkaline medium. Fehling solution have Fehling A which contains $CuSO_4$ which normally occur in alkaline solution. Fehling's solution B is alkaline solution of Rochelle's salt.

## Hypothests :

Fruit juice & sweet materials contain sugar. In the presence of reagents like Fehling A & Fehling B & methylene blue reducing & non reducing sugar can be estimated.

## Objective :

To determine the reducing & non reducing sugar in the different food samples. To calculate % of sucrose in different food samples.

**Procedure:**

1. **Preparation of solution:** Jaggery Solution was prepared by weighing 5 gm of jaggery by grinding it in motar pestle with about 50 ml of distilled water. This solution was transferred in 250 ml volumetric flask. It was diluted upto the mark & made into a homogeneous solution.

   Sugar solution was weighed & dissolved in 50 ml of water & made homogeneous solution in 250 ml volumetric flask.

   Juice (i.e. mango, pomegranate, apple & beet root) was extracted from extractor & 5ml of it was distilled with water in 250 ml volumetric flask.

2. **Standardisation of glucose:** 5ml of Fehling A & Fehling B was pipetted out in a clean 250 ml conical flask.

   Standard glucose solution was filled in burette.

   10 ml of Fehling solution was taken in conical flask.

   The content was heated for sometime.

   On vigrous boiling standard glucose solution was added dropwise. 3-4 drops of methylene blue was added till the appearance of brick red colour.

3. **For reducing sugar :** This test is only for the sample containing reducing sugar.

   100 ml of the juice solutions prepared as above was taken in 250ml volumetric flask & diluted with distilled water upto the marks & mixed well to homogenize.

   This solution was taken in a burette and titrated against Fehling solution to get concurrent reading.

   Fehling solution turns brick red in colour.

4. **For Non-reducing sugar :** This test is only for non reducing sugar i.e. disaccharide whose carbonyl group is not free.

   Since it contains sucrose, a non reducing sugar, it was hydrolysed.

   Hydrolysis was performed by mixing 10ml of 6N HCl & 50 ml of original solution of juice.

   The mixture was heated for half an hour & after cooling it was neutralised by 30% $Na_2CO_3$.

   Solution was transferred in 250 ml volumetric flask.

   The solution was filled in burette and titrated against Fehling solution to get the concurrent reading.

   Fehling solution turns red in colour.

**OBSERVATION : FOR REDUCING SUGAR**

| Sl. No. | Sample | Vol. of Sample Taken | Vol. of Fehling Solution (A & B) taken | Concurrent reading | % of reducing sugar |
|---|---|---|---|---|---|
| 1. | Honey | 10ml | 10ml | 7.1 | 10.30% |
| 2. | Table Sugar | 10ml | 10ml | 20.0 | 36.71% |
| 3. | Jaggery | 10ml | 10ml | 26.0 | 28.00% |
| 4. | Pomegranate | 10ml | 10ml | 25.4 | 25.40% |
| 5. | Apple | 10ml | 10ml | 26.3 | 31.00% |
| 6. | Mango | 10ml | 10ml | 58.0 | 39.00% |
| 7. | Beet Root | 10ml | 10ml | 20.0 | 36.71% |

**OBSERVATION : FOR NON REDUCING SUGAR**

| Sl. No. | Sample | Vol. of Sample Taken | Vol. of fehling Solution (A & B) taken | Concurrent reading | % of reducing sugar |
|---|---|---|---|---|---|
| 1. | Honey | 10ml | 10ml | 14.2 | 0% |
| 2. | Table Sugar | 10ml | 10ml | 50.0 | 7.31% |
| 3. | Jaggery | 10ml | 10ml | 55.0 | 2.00% |
| 4. | Pomegranate | 10ml | 10ml | 55.4 | 2.40% |
| 5. | Apple | 10ml | 10ml | 46.1 | 4.00% |
| 6. | Mango | 10ml | 10ml | 37.0 | 27.00% |
| 7. | Beet Root | 10ml | 10ml | 60.0 | 12.24% |

**RESULT:**

| Sample No. | Sample | % of Reducing Sugar | % of Non Reducing Sugar | % of Sucrose |
|---|---|---|---|---|
| 1 | Honey | 10.3 | 0.00 | 10.31 |
| 2 | Table Sugar | 36.71 | 7.31 | 6.98 |
| 3 | Jaggery | 28.0 | 2.0 | 1.90 |
| 4 | Pomegranate | 25.4 | 2.0 | 1.98 |
| 5 | Apple | 31.0 | 4.0 | 3.80 |
| 6 | Mango | 39.0 | 27.0 | 25.65 |
| 7 | Beet Root | 36.71 | 12.24 | 11.62 |

**Discussion :**

Effects of difference of sugar concentration in our body.

Our food is incomplete without sweetening agent. It is very important to our health as the simplest form of

sugar i.e. glucose plays a vital role in our body. Inspite of thing consumption of sugar leads to many diseases such as obesity, diabetes, coronary heart disease.

Deficiency of sugar means relative excess of fat which leads not only to the production of abnormal substance, such as the ketones whether inert or toxic but also to an increased catabolism of proteins.

Deficiency of blood sugar i.e. glucose in our body will cause hinderance in the process of respiration . During respiration glucose breaks into $CO_2$ & $H_2O$ & releases energy which is used far various metabolic activities by the organism. If this glucose level reduces respiration will be on slower rate and hence the organism will be deprived of energy.

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