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Dough strength define perfect mixing for hard/fermented dough Biscuit

Kiranmay Mukherjee

Jadavpur University, Kolkata, West Bengal

Kiranmay.mukherjee@rediffmail.com

Abstract

- Dough strength measure the strength of the dough which developed during mixing in case of hard dough and fermented dough variety biscuit production. Dough strength value can be define the perfect dough/mixing.
- Dough strength is measurable parameter it can define the perfect dough/mixing in different variety of biscuit in case of hard dough or fermented dough where gluten development is allowed.
- Perfect dough in every batch reduce the variation and wastage.
- With the change of raw material consignment, mainly wheat flour dough consistency changes, as quality and quantity of gluten, WAP, ash content varies consignment to consignment and 60 to 70% is the wheat flour in biscuit. So to make the perfect dough, dough strength parameter can be used and make it perfect with adequate changes of water, enzyme, dough conditioner quantity.

Keywords:- Variation and wastage control, Dough strength measurement system, Definition of perfect mixing/dough

Variation Control in Hard Dough and Fermented Dough Biscuit Manufacturing

1. Introduction

Hard dough and fermented dough biscuits—such as Marie, Top, Crackers, are popular for their crisp bite, clean surface texture, and balanced layering. Unlike soft dough biscuits, these products rely on well-controlled dough fermentation, precise sheeting, and consistent baking conditions. Even minor variations in raw materials, process steps, or equipment can result in noticeable product defects.

Variation control, therefore, becomes a cornerstone of quality assurance and cost optimization in this segment. This article explores the common causes of variation in hard/fermented dough biscuit lines and presents practical solutions for reducing inconsistencies and improving overall process reliability.

2. Sources of Variation

a. Raw Material Variability

- **Wheat Flour:** Variation in protein content, ash value, and water absorption leads to inconsistent dough strength and extensibility. So whenever wheat flour consignment changes or supplier changes dough consistency also changes and you have to change the mixing parameter for uniform product.
- **Yeast (where applicable):** Yeast activity is affected by storage, age, and temperature. Irregular proofing behavior can lead to unpredictable dough volume and texture.
- **Water:** Temperature and hardness directly impact gluten formation and dough temperature.
- **Fats, enzyme and dough conditioner :** Quantity of fats enzyme and dough conditioner and their activity also changes the dough consistency.

b. Dough Mixing and Fermentation

- Over- or under-mixing alters gluten development, leading to variation in dough handling and finished product texture.
- Fermentation time and temperature control are critical; deviations affect dough rise and acidity.
- Inconsistent dough resting can result in uneven extensibility during sheeting.

Conclusion of variation

- **Main focus is to maintain dough consistency, Now question is that how do we define that dough is perfect for particular product or it is perfect for fermentation or it gives good machinability in sheeting and cutting or it good shape size and thickness of the finished product at standard baking profile**.

Definition of perfect Dough

- In mixing process energy develop in dough due application of mechanical forces. We can measure the strength of the dough and corelate with the quality of the Finished product at a standard baking profile and standard sheeting profile,
- For different variety and different shape size of the product dough strength will be different.
- For rectangular, square and round biscuit dough strength will be different.
- **After standardization we can define the perfect dough in terms of dough strength**.

Present scenario

- In case of Hard dough/ Fermented dough variety, biscuit forming process is too long. Primary sheeting, laminating, final sheeting , relaxation then cutting, and baking If any changes required for improvement of Biscuits, result will be reflected after 1hrs or 1.5 hrs of change in mixing process.
- In case fermentation process if rise and fall not match with our standard due to variation of wheat flour quality, it will be reflected after 3hrs(fermentation time) correction will be taken after 3hrs, in between this time Finished products will not meet our standard.

New development and its benefit

- **Define perfect dough for Hard Dough, Fermented dough or any stage of fermentation like slurry…etc in terms of Dough Strength.**
- **Standardised the dough strength for every variety and every fermentation stage in standard baking profile and standard sheeting process.**
- **If Dough Strength is known for a particular dough, what ever be the change in wheat flour quality we can adjust it by adjusting other parameters.**

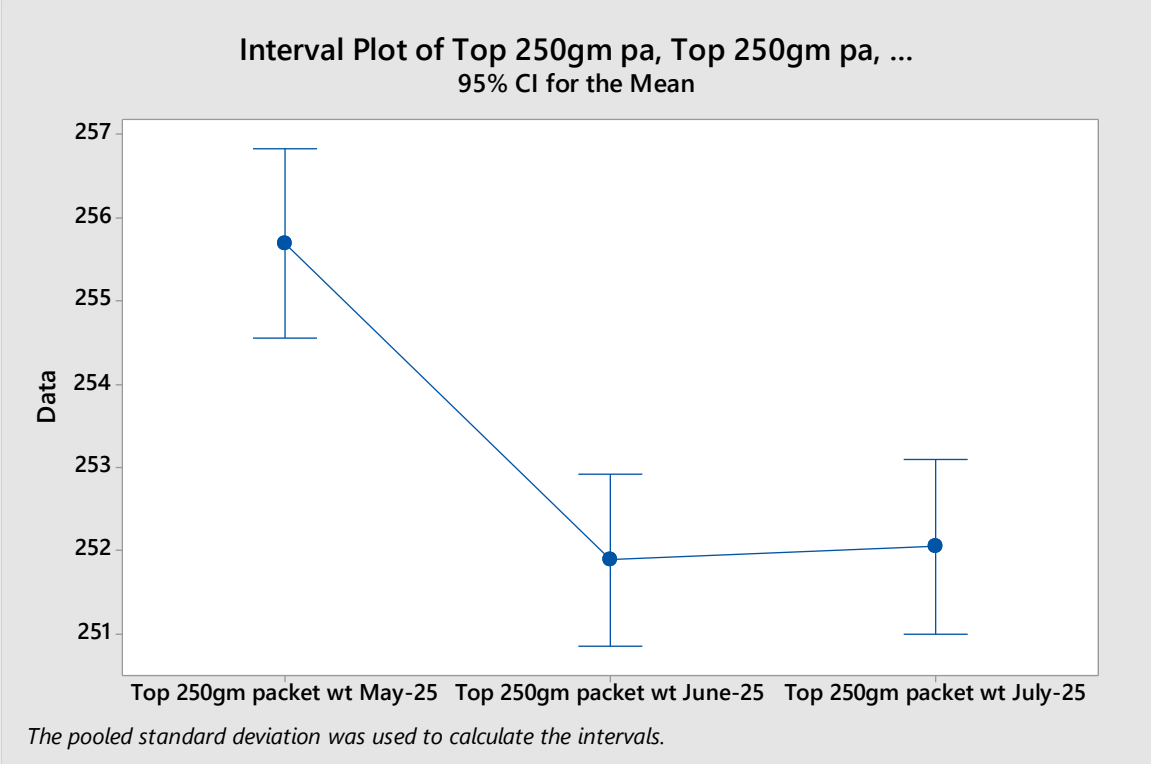
Factor effecting Dough strength

- **There are several factors which is effecting the dough strength.**
- **Water quantity effect the dough strength. It is inversely proportional to the dough strength, ie with the increase of water in mixing, dough strength decreases.**
- **Mixing time is directly proportional to the dough strength, ie with increasing mixing time dough strength increases.**
- **Enzyme and dough conditioner quantity is inversely proportional with the dough strength, ie with the increase of dough conditioner or Enzyme quantity dough strength decreases.**

Case study and result discussion

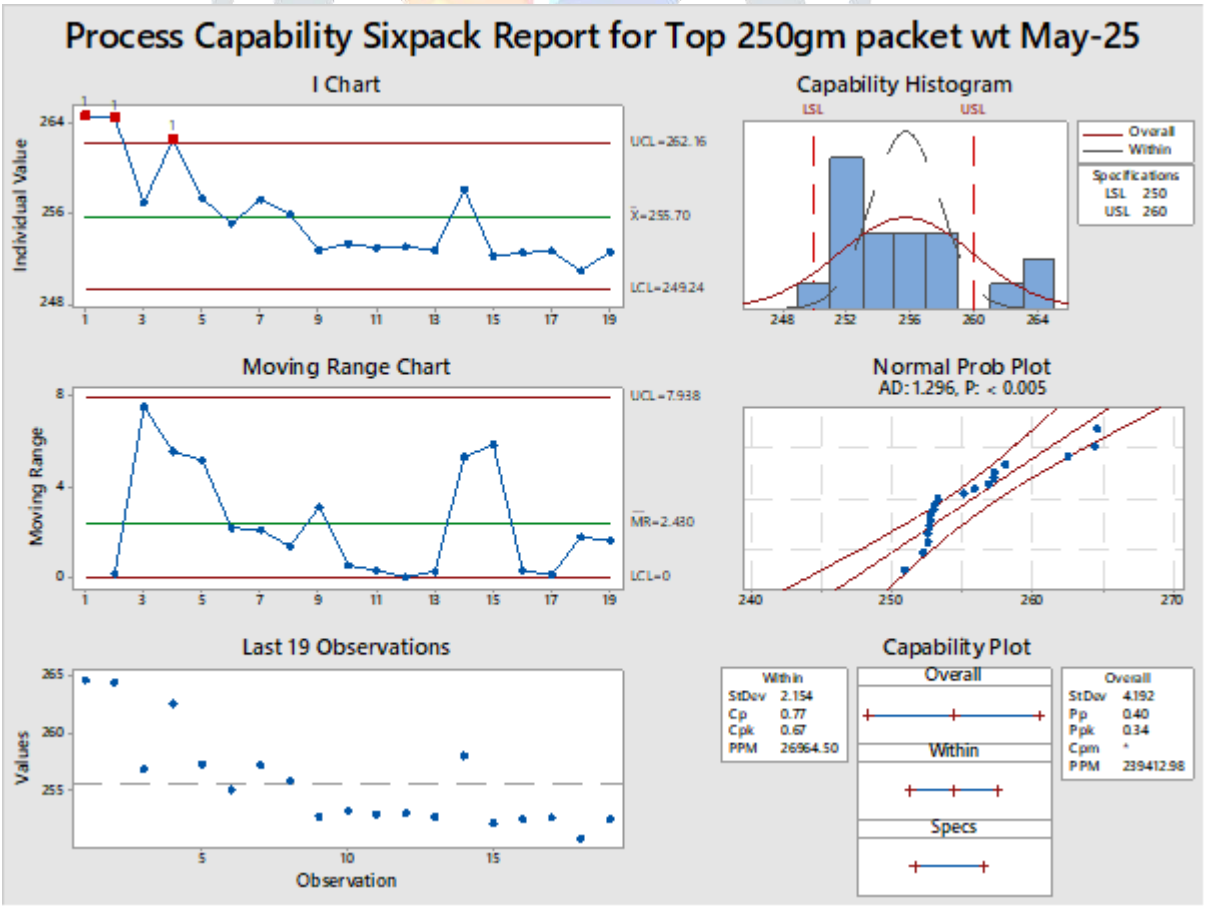
- Detailed study have been carried out on hard dough variety, rectangular Top and round Marie biscuits. It is found that for round Marie Biscuit dough strength is required 15-20 gf /(150*10*5)mm where as in rectangular Top variety it is required 50 -55 gf/(150*10*5)mm.(Both study has been done with particular recipe, dough strength may be changes with the change of recipe and cutter design).
- It is observed that with chang of dough strength quality of the product changes with standard baking and sheeting profile. It is found that after changing the particular wheat flour consignment with same mixing parameter dough strength reduced to 28 gf/(150*10*5)mm for Top variety as a result thick of the biscuit reduced, at that moment after reducing the enzyme quantity to some extent again dough strength increase to 55gf/ (150*10*5)mm and biscuit thickness improved up to standard with same baking and sheeting profile, It indicates that the quality of gluten it that particular wheat flour consignment is not good enough with respect to earlier one, for that reason in same mixing parameter with the change of wheat flour consignment dough strength decreases.
- In another case it is found that with the change of particular wheat flour consignment dough strength increase to 85gf/(150*10*5)mm and dough become hard, after increasing some qty of water in next batch, dough strength reduced to 55gf/(150*10*5)mm, It indicates that gluten quality of particular wheat flout is strong and water absorption power is high. High dough strength dough creates problem sheet formation section and shape size of finished good become poor.
- So in case of a particular variety if dough strength is known, if any parameter changes which will effect the dough strength ie Quality of wheat flour, temperature, water, enzyme….. etc it is easily predictable that the dough will give standard product or not, and what action is required. If dough strength is not known then after any changes we have to wait for 1 to 1.5 hrs for result, if result is not satisfactory then after taking corrective action we have to again wait for 1 to 1.5 hrs for result, in the mean time we have nothing to do, only accept wastage/overage/poor quality.
- Another study is there with mixer machine, Horizontal sigma mixer and vertical mixer both are used in hard dough, fermented dough variety, it is found that with same mixing time dough strength is for different mixer, ie mixing time and other variable ingredients like water, dough conditioner should change for different mixer to maintain standard dough strength for a particular variety.
- With the help of known dough strength we can reduce the variation in quality, wastage and overage.
- We have done pilot project on it and excellent result observed. Pilot project was carried on Top cracker (Hard dough variety) data collection done on before implementation of dough strength measurement and after implementation

of dough strength for two month and lots of improvement observed on overage control and wastage control.



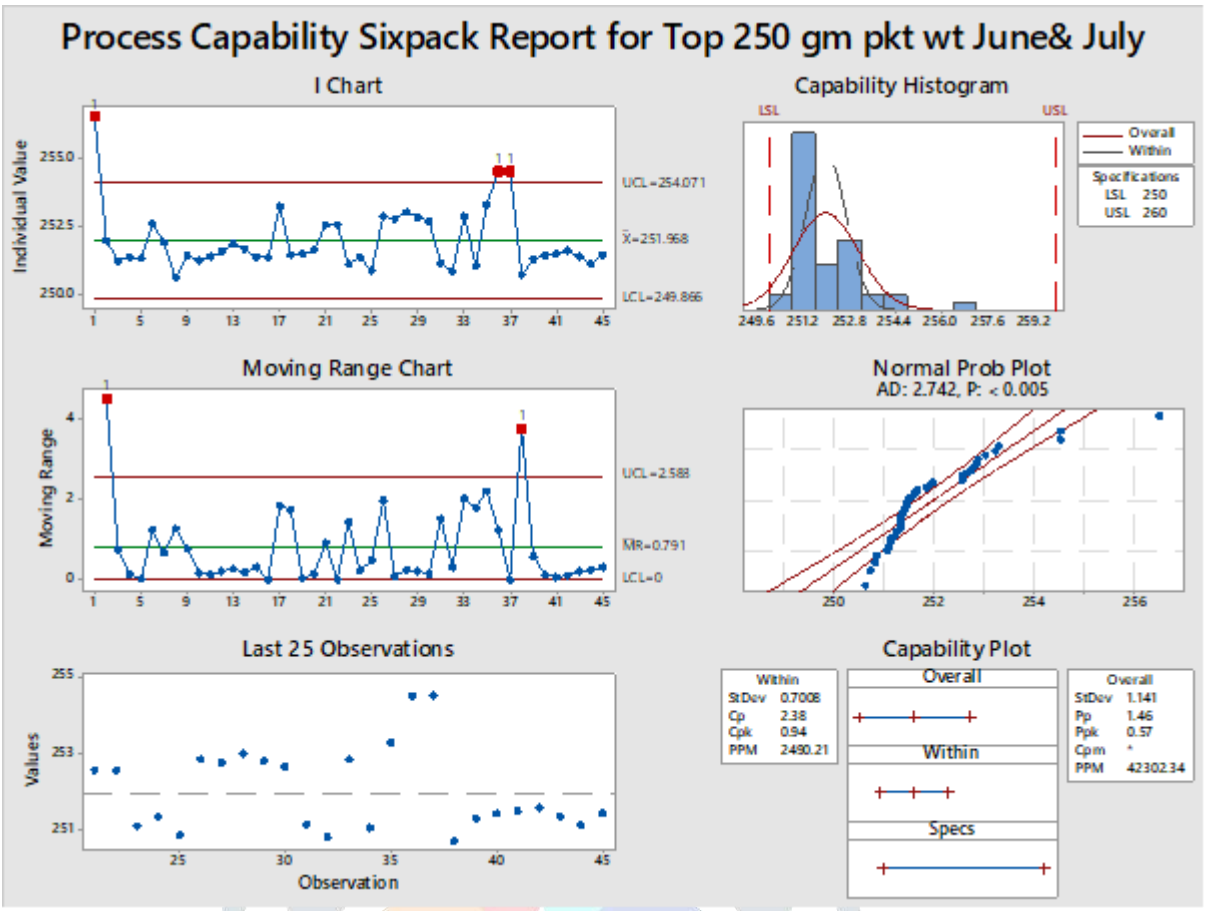
- This interval plot clearly indicates that the improvement in overage after implementation of dough strength measurement concept from June-25 .

Data analysis before implementing dough strength measurement concept



- Before implementation of Dough strength measurement concept, there was very high batch variation whenever wheat flour consignment changes as a result long time was required to set the mixing parameter for this particular wheat flour consignment.

- After implementation of dough strength checking concept in the month of June -25 data collection done for last two month an get very good result.

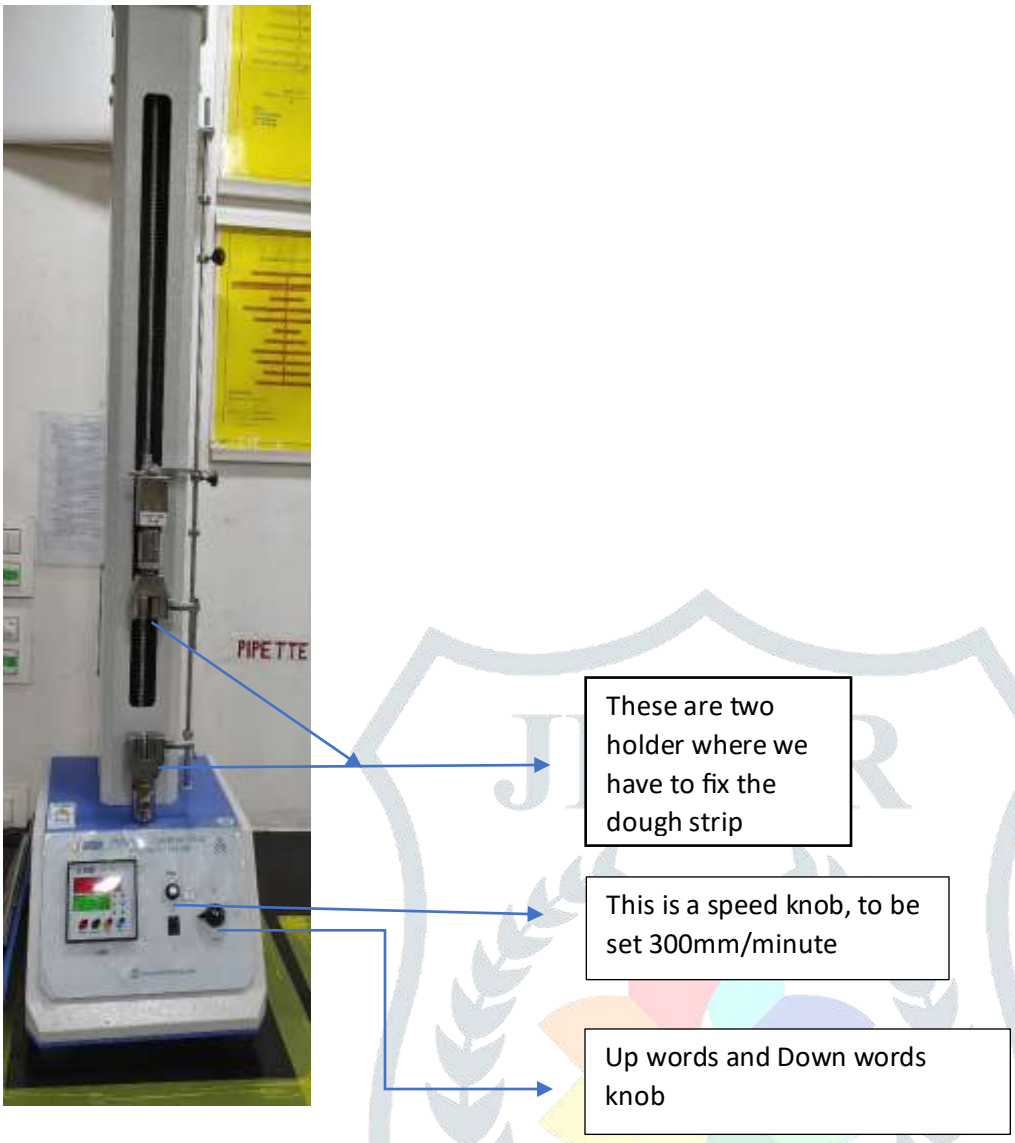


- Before implementation of dough strength Cp and Cpk value found 0.77 &0.67 and after implementation of dough strength measurement system batch variation is in controlled and it will take very less time for standardization of batch whenever wheat flour consignment will change. For that reason variation of overage and wastage within control and Cp value is 2.38 and Cpk value is 0.94.

Method for measuring Dough strength.

Procedure :- Instrument used for measuring dough strength is bond strength taster.

Make a dough strip using a standard box, length of the dough strip should be 150 mm, width of the dough strip should be 10mm and height of the dough strip should be 5 mm. Now put the dough pieces in bond strength machine, tighten the lower and upper clip, tare the machine and make it zero, run the machine up word direction, note the highest peak value, multiply the value by 1000 and result will be gf/(150*10*5)mm.



Bond strength Machine

Conclusion :-

As per recipe each and every hard dough and fermented dough must have standard dough strength, once it is standardized it will take very short time to correct the mixing parameters with the changes of wheat flour consignment. It will also help to reduce overage, wastage and quality defects.

References :-

- Benham, P.P. and Crawford, R.J., Mechanics of engineering materials. Essex, England: Longman Scientific & Technical (1987).
- Technology Involved in Quality of Biscuits: Influence of Factors and Impact on Processing – A Critical Review, **B. Dayakar Rao and G. Bhargavi** *Int. J. Pure App. Biosci.* **5 (4):** 532-542 (2017)
- Contamine, A.S., Abecassis, J., Morel, M.H., Vergnes, B. and Verel, A., The effect of mixing conditions on the quality of dough and biscuits. *Cereal Chem.*, **72:** 516-522 (1995).
- Maache Rezzoug, Z., Bouvier, J.M., Allaf, K., Tayeb, J. and Patras, C., Study of mixing in connection with the rheological properties of biscuits dough and dimentional characteristics of biscuits, *Journal of Food Engineering*, **35:** 43–56 (1998)