

# **Theories of Churning and Butter colour**

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**Theories of Churning:** There are three theories of churning which are describes below

### **1. Phase Reversal Theory**

Churning is process of phase reversal, i.e of changing oil in water emulsion (cream) to water in oil emulsion. The serum is in continuous phase, with fat globule suspended through it. Water phase in butter is discontinuous, the water being present as droplets of varying size.

Agitation in the churning of cream causes coalescence and clumping of the fat globule unit. Eventually the ratio of the surface area to the volume of fat units becomes so small that it can no longer contain all the buttermilk in the stable form. The fat in water emulsion then suddenly breaks; yield butter granules consisting of an emulsion of water in butter fat and free buttermilk.

### **2. Foam Theory**

Churning is entirely dependent on foaming. This foam producing substance, which gradually solidifies as the milk or cream, agitated. Churning can be done in the absence of air, although air and foaming accelerate the process. During churning protein and phospholipids are released from the surface of fat globule.

The fat globule, because of surface tension effects, tend to concentrate in the foam bubble, where they are brought into such close contact they become packed in lump which gradually increase in size. The foam-producing substance assumes a solid character and the foam collapse. The fat globules then coalesce and butter is formed.

### **3. King's Modern Theory**

1. In cooled cream at churning temperature, the fat globule and within each globule it is present partly in solid and partly in liquid form.
2. Churning breaks up the cluster and causes the foam/froth formation. The globule concentrated to some extent in the film around the air bubble in the foam and is thus brought into close contact with each other.
3. The movement of the globule over one another into the foam film and the direct concussion between them causes a gradual wearing away of the emulsion-protecting surface layer of phospholipids- protein complex. The globules then adhere together to form larger and longer particles. Eventually these particles become visible as butter grain (granules). As the granules form, they enclose some of the air from the foam. The fat in the granules is still mainly in globular form.
4. The working of the butter grains causes the globules to move over one another under the effect of friction and pressure; some of them yield up a portion of the liquid fat. Others are broken up during working. Finally there is enough free liquid fat present to enclose all the water droplets, air bubbles and intact fat globules.

### **Butter colour:**

To satisfy the consumer demand, butter colour should have the following properties: It should be harmless, free from off-flavour, concentrated and oil soluble. Butter colours are generally manipulated with food colouring in the commercial manufacturing process, most commonly annatto or carotene.

