

Of Proteins and Meringue

The scientific explanation

Meringue is a mixture of egg whites and sugar, whipped together until its volume increases and a stable foam forms. Egg whites are superior foaming agents, which can increase in volume up to eight times that of their initial volume.

The first step in making meringue is to incorporate air into the egg whites by whipping them. Through this process, the egg proteins, whose initial structure is globular, unfurl into chains that trap air bubbles and thus the foam is formed. The key to success in making foam is to whip the egg whites up to the point at which the protein chains loosely surround the air bubbles, so that during baking, the loose protein structure allows the air bubbles to expand and form a soft and fluffy meringue. If the egg whites are whipped for too long, the bonds between the protein chains will become too strong, and the foam will solidify even before heat is applied, so that during heating, the volume of the foam cannot expand. If the whipped egg whites appear dry and grainy, they were probably over-beaten.

Sugar plays a vital role in making meringue. Beyond adding sweetness, it helps to stabilize the meringue's structure. When you beat sugar with the egg whites, the sugar dissolves in the water contained in the protein envelope coating the air bubbles - egg whites are more than 90% water. The combination of sugar, water, and protein enables creating the desired loose shell. The sugar should be added slowly during the whisking, to allow it to dissolve well and uniformly. During baking, the water evaporates, leaving delicate bubbles coated with a thin shell of protein and sugar.