What is Egg Shell Quality and How to Preserve It

Dr. Ken W. Koelkebeck
Department of Animal Sciences
University of Illinois

There are many factors that affect the overall quality of the egg shell, but before discussing these factors, it is important to know what makes up the structure of the egg shell. The egg shell consists of about 94 to 97% calcium carbonate. The other three percent is organic matter and egg shell pigment. There are also as many as 8,000 microscopic pores in the shell itself. The outer coating of the shell itself consists of a mucous coating called the cuticle or bloom, which is deposited on the shell just prior to lay. This protein-like covering helps protect the interior contents of the egg from bacteria penetration through the shell. Egg shell quality is determined by the color, shape, and structure of the shell. Colors can range from white to tints to brown and egg shape can also vary. Numerous factors affect the general functional quality of the egg shell. These factors affect the quality of the shell mostly prior to when the egg is laid. The thickness of an egg shell is determined by the amount of time it spends in the shell gland (uterus) and the rate of calcium deposition during egg shell formation. If the egg spends a short period of time in the shell gland, then shell thickness will be less. Also, the time of day when the egg is laid will also determine the thickness of the shell. In general, the earlier in the day or light portion of the photoperiod the thicker the shell will be. The amount or rate of calcium deposition will also affect the thickness of the shell. Some strains of birds may be able to deposit calcium for the egg shell at a faster rate than others. Another factor such as the age of the hen plays a role in determining the functional quality of the egg shell. As the hen ages, the thickness of the shell usually declines.

Other egg shell quality factors such as the formation of abnormal ridges, calcium deposits, or body checks (ridges) are important considerations in determining egg shell quality. The asthetic quality of egg shells relate to the quality factors which the consumer can see, such as soundness of the shell, cleanliness of the shell, shape of the

shell, and color of the shell. Several factors do affect asthetic egg shell quality. Factors such as wash water temperature which affects the incidence of "thermal" cracks, moisture condensation on the shell, refrigeration temperature, and mechanical handling of the egg all affect the asthetic quality of the egg shell. Microbiological contamination of the inside of the egg is greatly affected by the ability of the egg shell to stop the invasion of micro-organisms and bacteria from entering the egg through the shell's pores. When the cuticle or bloom is deposited by the hen on the shell this acts as a barrier to keep bacteria from entering the egg. When eggs are washed, however, this removes most, if not all, of the cuticle from the shell surface. Thus, bacteria have an easier time entering the egg after washing. Even when the cuticle is removed, the two inner shell membranes help prevent bacteria from entering the egg. These barriers provide a good line of defense against invading bacteria. Many factors can contribute to the conservation of good egg shell quality. If the egg producer manages his flock in the proper manner by providing the proper nutrition and environmental conditions, then high egg shell quality should be achieved. A specific procedure that a producer should do to assure the production of eggs with good egg shell quality is to avoid scaring the birds so that the egg spends the normal amount of time in the shell gland. A key item to remember is to not stress the flock in any manner.

Although it may not be practiced, the use of a "ahemeral" lighting program has shown to be effective in causing eggs to spend a longer time in the uterus, thus, producing eggs with thicker shells. Nutritionally speaking, it is important for the producer to feed a ration properly formulated with the correct amount of calcium and phosphorus in the diet (usually 3.5-3.75% calcium, .45%phosphorus). The production of eggs with thick, strong shells usually occurs from young vs. older flocks. Thus, a producer should expect more shell breakage and eggs produced with thinner shells to occur with older flocks and those producing eggs a couple of months after they've been molted. It is also important for the producer to monitor the health of the flock. Since diseases such as Infectious Bronchitis and Newcastle cause egg shell abnormalities in the texture of the shell and shape of the shell, producers should continually monitor their flock

for these diseases and follow management practices to avoid their flock from contacting these diseases. One of the egg shell quality problems that often occurs is the production of eggs having body checks. These are eggs which are cracked in the uterus during shell formation, then the egg shell forms on top of the crack. Robert Bastian reported in a newsletter published by the University of Georgia (Commercial Egg Tips) ways for producers to reduce the problem of body checks. His recommendations were to:

1. Avoid overcrowding of hens in cages which produces body checked eggs because hens contact themselves and the sides of the cage;
2. Use flocks that are of a relatively young age because older flocks produce more body checked eggs;
3. Use a lighting program which is no longer than the longest natural light in open houses.

There are several procedures that need to be followed in order to conserve the aesthetic quality of egg shells. The frequent gathering of eggs will help prevent the accumulation of dirt and stains on the shell. In addition, when eggs are washed the temperature of the wash water should be about 20°F warmer than the eggs. This will help prevent the occurrence of thermal cracks or "blind checks" as they are sometimes called. Today's in-line commercial gathering of eggs has helped reduce the incidence of checked and cracked eggs, but producers should still be aware of problems in the collection system that could damage eggs. As far as procedures followed to conserve micro-biological contamination of egg shells, appropriate washing and egg processing techniques should be followed. The use of the proper sanitizing agent is very important to maintaining egg shell cleanliness and free from bacteria contamination.