Embryo-Response incubation technology for healthy chicks

by Hugo De Ruyck, Sales and Marketing Manager, Petersime nv, Centrumstraat 125, 9870 Zulte (Olsene), Belgium.

Incubation is a complex biological process. Whether it is carried out naturally, under a parent hen, or in a mechanical incubator, several physical criteria need to be met in order to create an optimum incubation environment.

A lot of parameters influence the development of healthy chicks. It starts with genetics: every egg is unique. Furthermore, the origin and the management of the eggs before they enter the hatchery will help define the future development path of the embryo. Elements such as the type of mother bird, the flock age, the feeding management of the mother hen, transportation and storing conditions all help determine how an embryo will develop.

The most important environmental conditions are temperature, humidity and ventilation. Other variables such as sound, light, the position of the eggs, electromagnetic waves etc may also have an influence. Scientific research and field trials that aim to reveal the importance of these parameters are still on-going.

Incubation on an industrial scale is an even more challenging process, since we are dealing with many eggs at the same time.

Despite this, traditional incubation systems still use intermediate incubation parameters – ventilation rates, air temperature and air humidity – to manage the incubation process. As a result, they achieve lower hatching results than those nature would achieve at full genetic potential.

Petersime's patented Embryo-Response Incubation technology allows creating the same environment as what nature provides. Via on-line diagnosis of the real incubation parameters, the system constantly and interactively adapts the incubation parameters to create the optimal environment for each specific batch of eggs. Scientific research and extensive field trials have proven that chick quality and hatchability as well as post-hatch performance benefit greatly from this active control over embryo-response parameters during incubation.

The following Embryo-Response Incubation technologies are currently available on Petersime S-line incubators:

- CO_2NTROL for optimum CO_2/O_2 levels.
- OvoScan for optimum incubation temperature
- Dynamic Weight Loss System (DWLS) for optimum humidity levels.
- Synchro-Hatch for a reduced hatch window.

Temperature

Temperature is the most important environmental parameter, and a slight increase or decrease can seriously affect embryonic development, hatchability and post-hatch performance.

Measuring the embryonic temperature, however, is problematic because when the structural integrity of the shell is damaged, you risk bacterial infections and damage to the developing embryo.

The closest you can get to measure the embryonic temperature in a non-destructive way is to measure the egg shell temperature. Petersime's OvoScan automates the on-line temperature measurements on the barrier between embryo and environment – the egg shell – as an indication of heat exchange. By actively measuring this temperature, the incubator allows for adequate temperature control in accordance with the actual egg mass present in the machine.

The OvoScan system consists of a set of infra-red egg-shell scanning units and an intelligent controller holding the OvoScan algorithms. The sensors are positioned on three different locations on a trolley so as to provide a large sample measurement. OvoScan was developed and calibrated in cooperation with the University of Louvain.

Humidity

Humidity levels inside an incubator directly influence the speed at which eggs lose water, and as a consequence, lose weight.

The humidity level should be set in such a way that eggs lose about 14-15% of their initial weight during the entire incubation process.

Petersime's patented DWLS controls the humidity level in the incubator by measuring the weight loss of the eggs during the incubation process. DWLS will make sure that humidity levels are automatically adjusted to achieve the optimum weight loss trajectory from egg setting to transfer.

The DWLS system consists of a weighting balance system and an intelligent controller featuring the DWLS algorithms.

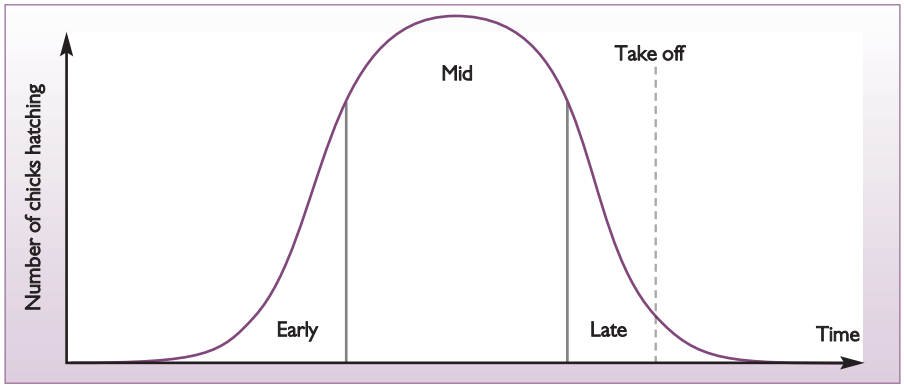
Ventilation

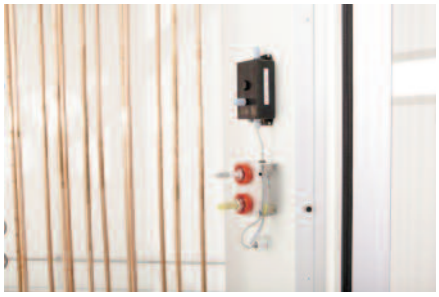
Ventilation of the air inside the incubator has two purposes: providing the necessary oxygen on the one hand and removing excess carbon dioxide on the other. Since

embryonic metabolism (O_2 intake resulting in CO_2 production) is not a linear process, ventilation levels need to be constantly adapted.

Petersime has carried out extensive field trials on a large scale to investigate the effect of CO_2 on the development of the embryo. The final results of those trials indicate that CO_2 level control results in stronger birds with higher meat yields and lower feed conversion ratios (FCR).

Initial higher CO_2 levels in the setter have a positive impact on the development of the cardiovascular system.





The use of CO_2 control during the hatching process offers significant gains in both hatch timing and chick uniformity.

The CO_2NTROL system consists of an intelligent controller, one or more CO_2 sensor units and the air mixing system.

By accurately measuring the CO_2 levels in the setter and in the hatcher and by driving the ventilation and air mixing systems, CO_2 concentrations can be set at different levels for every phase of the incubation process. The Embryo-Response Incubation algorithms will bring the CO_2 levels to predefined settings.

Hatch window

Hatching marks the end of prenatal life and represents a drastic change from a well protected environment to a more hazardous life outside the egg.

A chick emerges from the shell when it breathes entirely with its lungs, when the blood has drained from the chorio-allantoic membrane and when the yolk sac is fully withdrawn into the body cavity.

Some important phases during hatching can be defined; internal pipping, external pipping and final hatching. The speed at which all these processes occur, determines the chick quality and can be influenced by conditions in the hatcher.

Moreover, the length of the critical period of hypoxia or O_2 shortage at the end of incubation may also affect the chick quality.

Between internal pipping and hatching, the chick becomes able to regulate its body temperature. This ability is also influenced by conditions inside the hatcher and by the chick's hatching time.

In order to start lung respiration, the production of a special secretory product in the lungs called lung surfactant is needed. Lung surfactant is stimulated mainly by the corticosteroid hormone. It reduces surface tension which makes it possible for the chick to breathe.

Factors such as high CO_2 or low O_2 stimulate the production of corticosteroid and therefore stimulate lung surfactant synthesis and secretion.

This explains why mild CO_2 stimulation just before pipping and hatching is beneficial. At take-off, the chronological age of the chick starts. Ideally, all chicks should hatch at the same moment in time. In reality, however, chicks hatch at different moments within a time period called the hatch window, which normally spans over several hours.

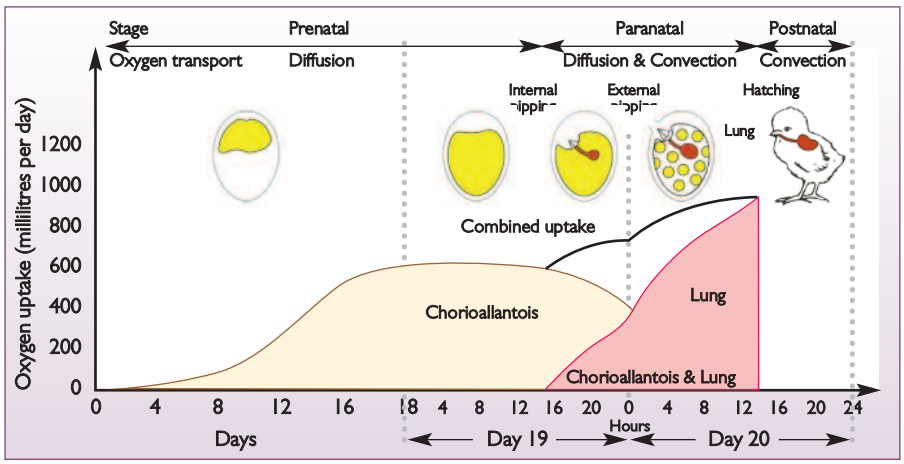
Due to the hatch window, a hatchery manager is dealing with chicks of different biological ages at take-off. Some chicks are older than one day and already show signs of dehydration, while others are just hatched and still wet.

In an industrial environment, it is important to control the moment of hatching in order to have chicks with similar biological ages.

Petersime has developed the Synchro-Hatch sensor, which allows hatchery managers to shorten and reshape the hatch window. By reducing the spread in biological age of the chicks at take-off, Synchro-Hatch leads to uniform chicks.

The system consists of a Synchro-Hatch sensor unit and an intelligent controller featuring the hatching algorithms. The sensor is attached to the chick baskets and monitors the activity of the embryos.

Synchro-Hatch steers the hatching process by triggering a number of stages in the hatching cycle of the embryo. It enables a synchronisation of the hatching of all chicks by a sequence of CO_2 and temperature triggers and by precisely monitoring the behaviour of the developing embryos in the hatcher basket.



Conclusion

All incubation parameters need to be exactly controlled and timed in order to produce a batch of uniform chicks. The Embryo-Response Incubation technology will take care that this is done in an automated way taking into account the key external factors that influence the incubation process.

Petersime has developed different incubation profiles for different types of fowl and flock ages. These incubation profiles are the result of extensive large field trials, partnerships with universities and close cooperation with breeding companies.

With Embryo-Response Incubation technology you are assured peace of mind. ■