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# Increasing efficiency in commercial sex reversal of tilapia with pulses electric fields

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This research had been extended from our previous project of electrical sex reversal for monosex-male Nile tilapia by using pulse-electric fields (Fish X-Change) to increase all-male sex reversal (MSR), survival rate (SR), hatching rate (HR) and cleaning cell surfaces during the hatchery process. In order to reduce the mortality rate and increase the survival rate, the effect of high-voltage pulse electric fields on tilapia's egg surfaces with various pulse waveforms of square pulse-electric fields, sequential exponential-pulse electric fields and ultrasound-immersion techniques combinated with transient-pulse electric fields were examined through experiments. The optimized pulse-wave forms of the signal with periods (range of micro-second), number of pulses, amplitudes and appropriate suspending medium for electrical inductions were verified with simulations of theoretical electrical parameters. Verifications of experiments were made through SEM micrographs of cell surfaces before and after inductions with various electric fields waveforms, number of holes on the cell surface, hole density, main pore at the top, opened hole diameter (hole crater), sharpness and edge cleanliness. The amount of bacteria before and after electrical inductions were also investigated using staining technique. The results of hatching and survival rate were recorded in the first-week fry (from larvae to fry). For our first pilot experiment, all male sex reversal rates of tilapia eggs treated with 1,500 microgram/litre of androgen hormone were achieved at the maximum values of 91.25%±1.13% (mean ± SD) with the induced voltage of 375.50 VDC, HR of 91.70%±5.13% and SR of 90.44%±3.15%, less than 10% egg death. The most suitable stages of egg development (day post fertilization: dpf) during zygote (1dpf)-cleavage-blastula-segmentation (2dpf)-pharyngula (3dpf) were carefully selected for electrical sex reversal but pharyngula was the optimized phase. This project can also be extended to kill TiLV virus and other bacteria on the egg's surface that cause Tilapia disease which are currently in urgent need.

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