M11 Evaluation of objective methods to detect woody breast and white striping myopathy
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White striping (WS) and woody breast (WB) myopathies are major issues in the broiler industry attributed to faster growth rate in chicken. Currently, these myopathies are scored by subjective methods such as visual assessment and touch. Subjective methods for quality assessment are dependent upon the evaluator, are unreliable and lack repeatability. Alternatively, information on objective methods to detect WS and WB is lacking. The aim of this experiment was to evaluate objective techniques such as color and texture in conjunction with subjective methods to evaluate WS and WB.

Broiler chickens (Hubbard x Cobb; n=166) were processed at 50 days of age. Carcasses were deboned approximately 24 h post-rigor. The left breast filet was used for color measurements (L* a* b*) and scored visually for WS (Normal, Moderate, Severe) while palpitation method was used to score WB (0 = No woody breast, 1 = <50% and 2 = >50% woody breast). The right filet was weighed, cooked in a convection oven to 74°C (internal temperature), cooled down and weighed again to determine cook loss. A 5g sample of the cooked filets was then used to determine shear force using a 10 blade Allo-Kramer Shear Cell. Accumulated data was analyzed using Pearson Correlation (a=0.05) and Logistic Regression (a=0.05).

Out of the 166 filets, 29% had severe WS while 34% samples had a WB score of 2. Shear force and cook loss ranged from 11.29 kgf to 54.31 kgf and 18.18% to 50.13%, respectively. Pearson correlation showed that cook loss and shear stress had a significant relation WS and WB but the r value was low. However, there was a significant relation between cook loss and shear stress (r=0.38). Color was not a significant predictor of WS and WB. Logistic regression revealed shear force and cook loss can predict WB score, and shear force can predict WS score.

Results indicate shear force and cook loss can be used to predict WB and WS scores, but additional studies should be conducted to reinforce these results.

Key Words: Woody breast, White striping, Texture analysis, Myopathies, Broiler

M12 Occurrence of white striping and wooden breast in broilers fed diets with increasing levels of lysine in grower and finisher phases
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White striping (WS) and wooden breast (WB) are two important myopathies in poultry industry that affect breast meat quality and consumer acceptance. The objective of this trial was to evaluate the occurrence of WS and WB and the severity of these myopathies in broilers fed with increasing levels of lysine (Lys) in grower (12 to 28 d) and finisher phases (28 to 42 d). Two experiments were conducted using a total of 1,200 1-d-old Cobb 500 male broilers with 6 treatments and 8 replicates. Two corn-soy basal diets were formulated with 0.77% dig. Lys (experiment 1) and 0.68% dig. Lys (experiment 2). Increasing levels of L-lysine HCl were supplemented to the basal diets, in experiment 1 (12 to 28 d), 0.85, 0.93, 1.01, 1.09, and 1.17% dig. Lys and in experiment 2 (28 to 42 d), 0.76, 0.84, 0.92, 1.00, and 1.08% dig. Lys. A standard corn-soy broiler diet was provided before and after the experimental periods. Growth performance was evaluated during the experimental period. Four birds per pen were processed to evaluate carcass and breast weight and occurrence (% of total) of WS and WB and severity degrees of myopathies in breast meat of broilers. These evaluations were done with 35 d (experiment 1) and with 42 d (experiment 2). Severity degrees of myopathies were classified in three scores for WS and four scores for WB. In both experiments, birds fed with progressive increments of dig. Lys had higher body weight, breast and carcass weight when compared to the basal diet. Occurrence of WS and WB in grower phase was 31.25 and 85.94%, respectively. From 28 to 42 d, the occurrence of WS and WB was 89.01 and 89.24%, respectively. Lower occurrence and severity of WS were observed in the basal diet with 0.77% of dig. Lys compared to the diet with 1.01% of dig. Lys in experiment 1. The same result was observed in experiment 2 where lower occurrence and severity of WS were observed in the basal diet with 0.68% of dig. Lys when compared to the diet with 0.92% of dig. Lys. Wooden breast had higher occurrence in broilers breast with increasing levels of Lys (93.75% of occurrence with 1.01% of dig. Lys, experiment 1) and 100% of occurrence with 0.92% of dig. Lys, experiment 2) when compared to the basal (65.62 and 51.61% of occurrence for experiment 1 and 2, respectively). A strong correlation was observed for WB and breast weight (0.618 and 0.702 for experiment 1 and 2, respectively). In conclusion, the myopathies could be associated with increasing levels of dig. Lys and with breast weight of broiler chickens.

Key Words: broiler, breast meat, myopathies, lysine

M13 Effects of qualitative nutrient allocation on myopathies of the Pectoralis major muscles in broiler chickens at 48 d of age
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Quantitative control of nutrient intake may decrease the incidence of common breast muscle myopathies [white striping (WS), wooden breast (WB), and idiopathic necrosis (N)] with some impairment in live performance at a given age. An experiment was conducted to determine if a similar reduction in myopathies may be obtained by modulating dietary nutrient density. Male broiler chicks of a high-yielding commercial strain were placed into 63 pens (25 birds/pen). All birds received an identical prestarter diet until 7 d of age. Thereafter, each pen was randomly assigned to 1 of the following 7 dietary treatments (TRT) for the starter (8 to 15 d), grower (11 to 25 d), finisher (26 to 42 d), and withdrawal (43 to 50 d) phases: 1) 100% of primary breeder nutrition specifications for amino acid and metabolizable energy density throughout experiment; 2) 95% of TRT 1 until 10 d of age, then as TRT 1; 3) 95% of TRT 1 until 24 d of age, then as TRT 1; 4) 95% of TRT 1 throughout experiment; 5) 90% of TRT 1 until 10 d of age, then as TRT 1; 6) 90% of TRT 1 until 24 d of age, then as TRT 1; 7) 90% of TRT 1 throughout experiment. Feed intake and mortality were recorded daily. Individual bodyweight (BW) was recorded at 14, 25, 34, 42, and 47 d of age. Blood samples were collected from 4 birds per pen at 18, 25, 35, and 43 d of age and were subsequently analyzed for plasma creatine kinase and lactate dehydrogenase. At 48 d of age, 18 birds per pen were randomly selected for processing and the right breast fillet of each bird was visually scored for WS, WB, and N. Within the range of nutrient density tested, chicks adjusted their feed intake sufficiently to achieve similar final cumulative caloric intake and BW. Broilers consuming TRT 7 had increased (P ≤ 0.01) actual feed conversion ratios compared with TRT 1 and 5. No differences were observed for WB, WS, or N (P > 0.05). Plasma creatine kinase and lactate dehydrogenase increased (P ≤ 0.05) with increasing scores for WB, WS, and N. Further research is warranted to identify a qualitative feeding strategy that supports broiler growth trajectories which reduce the incidence and severity of breast myopathies, while minimizing the impact on live and processing performance.

Key Words: broiler, lysine, energy, breast fillet, myopathy

M14 The effect of pasture vs indoor rearing on the breast filet shelf-life of commercial-meat chickens and alternative breeds
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This study looked at the effect of pasture-rearing on breast filet shelf-life of commercial-type meat chickens (BR) and three alternative breeds, Rhode Island Red (RR), Brown Leghorn (BL), and Cornish Cross (CC). Sixty birds of each breed were raised either indoors or on pasture until market age (42 days). Birds were then rendered meat and stored at -2 °C for 12 weeks. At weekly intervals, 10 breast fillets from each treatment were removed and stored at 4 °C for shelf-life analysis. shelf-life analysis. Quality attributes (color, pH, and texture) were measured weekly. Results showed that pasture-rearing significantly prolonged shelf-life compared to indoor-rearing for all breeds. This study provides evidence that pasture-rearing may improve the shelf-life of chicken breast fillets.
Consumption of improperly prepared or handled chicken increases chances of exposure to Salmonella. The prevalence of Salmonella on raw broiler carcasses is reported as 4.8%; however there is an increase of this bacterium of almost 25% more in ground poultry products. Current management practices have shown to reduce levels of Salmonella Enteritidis (SE) in whole carcasses, but there is still a misunderstanding of why SE prevalence increases with ground poultry products. A series of studies were performed in which chickens were inoculated at day 0 with 10^6 SE via multiple routes of infection. From these results better management practices can be elucidated. The inoculation routes of interest include continual exposure of SE through feed or SE exposure on day 0 via inter-tracheal, oral, eye, cloacal or subcutaneous challenges. Each inoculation trial included 70-100 straight run broilers. On days 32-36, each bird was euthanized and necropsied for the following samples: bursa and thymus (BT) (pooled), breast, ceca, crop, kidney, liver and spleen (LS) (pooled), colon (NS), spinal cord (SC), thigh meat (TM), and trachea. A sterile swab sample was taken from the abdominal cavity (AC), bone marrow from the femoral head (BM), cloaca and lung. All tissue samples had at least one positive isolate for every inoculation route. The feed inoculation had the most positive samples as well as the highest percentages with the crop, ceca, BT and cloaca being prevalent in over 80% of the birds. The subcutaneous injection had the opposite effect with all but crop and NS having less than 10% prevalence. Positive samples of the breast, thigh and SC for every inoculation route occurred in less than 10% of the samples. Samples that were taken near an area of inoculation resulted in a higher percentage of SE prevalence. This series of studies have shown that if SE is present in the feed the chance of the animal being positive is higher then the other inoculation routes due to the range of positive tissue samples as well as the high percentages of positive tissues. The overall results of these studies is if SE enters the bird it will be recovered.

**Key Words:** Salmonella, Salmonella Enteritidis, ground chicken

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**M16 Determination of the route of challenge and eventual colonization sites of Salmonella enterica serovar Enteritidis when chicks are inoculated on day 0** Elle V. Chadwick, Kenneth Macklin, James Krehling, Laci Mackay, Anthony Frazier, Bradley Schrader

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**M15 Assessing the impact of egg sweating on Salmonella Enteritidis penetration into shell eggs**

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**Key Words:** Heritage breeds, Breast files, Pasture-raised

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**M17 Using RNA-Seq Next Generation Sequencing to understand the variability in gene expression in Salmonella Heidelberg (SH) after exposure to disinfectants**

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**University of California Davis**

Next generation sequencing (NGS) such as RNA-seq technology allows for the rapid comparison of transcribed sequences (e.g. the ‘transcriptome’) from one or multiple genomes. This relatively novel technology allows for the development of a ‘transcriptional map’ of the chromosomal and plasmid RNA. Therefore, using this technique for the same bacterium in different environments would allow investigators to better understand the relationship between a bacterial pathogen and the environmental trigger(s) that induce virulence and resistance. In our study, we evaluated the transcriptomes of three strains of Salmonella Heidelberg (SH) after challenging them with cetylpyridinium chloride, acidified calcium hypochlorite and peroxyacetic acid for 90 minutes at 4°C. Then the different transcriptomes were compared in order to determine transcriptional differences of genes linked to virulence and survivability. From a HACCP perspective, this approach could be used to determine critical food safety parameters in a way never previously investigated in a food system environment. Ultimately, our goal is to identify conditions in a poultry processing plant that mitigate transcription of genes associated with virulence and survivability. The work is a novel approach toward post-harvest control of pathogenic bacteria. It reflects the potential synergy between DNA based detection technologies and RNA based approaches, which allow for a greater understanding of how bacteria responds to its environment (e.g. the chiller in these experiments). In order to isolate quality RNA from...
SH exposed to the disinfectants, a modified procedure based upon a Qia-gen RNA extraction kit and RNA clean XP beads was used. RNA quality was assessed using an Agilent Bioanalyzer, which uses the electrophoretic trace of the sample to determine the integrity of the RNA. Using this method, an RNA integrity number average of 5.4 was obtained.

**Key Words:** salmonella Heidelberg, disinfectants, next-generation sequencing, ma isolation

### M18 Proteomic analysis on broiler breast myopathies

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White Stripping (WS) and Wooden Breast (WB) are two conditions that adversely affect consumer acceptance as well as quality of poultry meat and meat products. The incidence of these conditions has increased tremendously throughout the world in the last few years. Both WS and WB are associated with heavier birds and characterized with degenerative myopathic changes in muscle. Previous studies showed that WS and WB in broiler fillets could result in higher ultimate pH, increased drip loss, and decreased marinade uptake. The main objective of the present study is to compare the proteomic profiles of meat samples (n=5 per group) with either – NORM (no or less myopathic lesions) or SEV (with severe myopathic changes). Proteins were extracted from these samples and analyzed using a hybrid LTQ-OrbitrapXL mass spectrometer (LC – MS/MS). Over 800 proteins were identified in the meat samples, among which 141 demonstrated differential (P<0.05) expression between NORM and SEV. The differently (P<0.05) expressed proteins were uploaded to Ingenuity Pathway Analysis® (IPA) software to determine the associated biological networks and pathways. The IPA analysis showed that eukaryotic initiation factor-2 (eIF-2) signaling, mammalian target of rapamycin (mTOR) signaling, as well as regulation of eIF4 and p70S6K signaling were the major canonical pathways upregulated (P<0.05) in SEV birds compared to NORM. The upregulation of these pathways indicate an increase in protein synthesis. This could be part of the cellular stress associated with ongoing muscle degeneration and the attempt to repair tissue damage in SEV birds. Furthermore, IPA analysis revealed that glycolysis and gluconeogenesis were the major downregulated (P<0.05) canonical pathways in SEV with respect to NORM birds. Downregulation of these pathways could be the reason for higher ultimate pH seen in SEV meat samples indicating reduced glycolytic potential. In conclusion, the comparison of proteomic profiles of NORM and SEV meat samples showed differences in protein profile which explains some of the observed differences in meat quality parameters. Future studies based on these differences could provide valuable insights into various cellular changes and identification of biomarkers related to WS and WB.

**Key Words:** Proteomics, white striping, wooden breast, myopathy, broiler breast meat

### M19 Texture analyses of cooked wooden broiler breast fillets after fresh and frozen storage

Gabriela Sanchez Brambila¹, Debolina Chatterjee¹, Brian Bowker¹, Hong Zhuang³, ARS-USDA; ²USDA-ARS

Broiler breast meat exhibiting the wooden breast condition is characterized as having an abnormally hard or rigid texture. The efficacy of using objective texture measurements to characterize the texture attributes of breast meat exhibiting this condition before and after cooking are not well understood. The objective of this study was to determine the effects of the wooden breast condition on texture measurements of broiler breast fillets both before and after cooking. Broiler breast fillets deboned at 3 h postmortem were collected from a commercial processing plant and categorized as normal, moderate, or severe WBC based on the incidence and severity of diffuse hardened areas throughout fillets and the degree of palpable rigidity. At 24 h postmortem, fillets were either cooked or frozen in a -20°C freezer. Thaw loss was determined based on the differences in fillet weights pre-freezing and post-thawing after the frozen samples were placed in a 4°C cooler for 24 h. Both fresh and frozen-thawed fillets were cooked to an endpoint temperature of 78°C and cook loss was measured based on fillet weight differences pre- and post-cooking. The entire experiment was repeated three times on three separate days. Results showed that the average thaw loss of normal fillets (5.2%) was significantly greater (P < 0.05) than that of the fillets categorized as either moderate (3.3%) or severe (3.9%) WBC, which did not differ from each other (P > 0.05). Regardless of meat freshness, cook loss of fillets with either moderate or severe WBC was significantly greater (P < 0.05) than that of normal samples. These results demonstrate that the effects of wooden breast condition on WHC vary with the methods used to measure meat WHC. Wooden breast condition increases cook loss of chicken breast fillets; however, it results in reduced thaw loss in frozen-thawed broiler breast fillets.

**Key Words:** Broiler breast meat, wooden breast condition, water-holding capacity, thaw loss, cook loss

### M20 Wooden breast condition results in reduced thaw loss in frozen-thawed broiler breast fillets

Hong Zhuang³, Brian Bowker¹ U.S. National Poultry Research Center

Wooden breast condition (WBC) is an emerging quality issue with broiler breast meat that significantly affects both raw and cooked meat properties. The objective of this study was to investigate the effects of WBC on meat water-holding capacity (WHC) estimated with different methods. Broiler breast fillets deboned at 3 h postmortem were collected from a commercial plant and categorized as normal, moderate, or severe WBC based on the incidence and severity of diffuse hardened areas throughout fillets and the degree of palpable rigidity. At 24 h postmortem, fillets were either cooked or frozen in a -20°C freezer. Thaw loss was determined based on the differences in fillet weights pre-freezing and post-thawing after the frozen samples were placed in a 4°C cooler for 24 h. Both fresh and frozen-thawed fillets were cooked to an endpoint temperature of 78°C and cook loss was measured based on fillet weight differences pre- and post-cooking. The entire experiment was repeated three times on three separate days. Results showed that the average thaw loss of normal fillets (5.2%) was significantly greater (P < 0.05) than that of the fillets categorized as either moderate (3.3%) or severe (3.9%) WBC, which did not differ from each other (P > 0.05). Regardless of meat freshness, cook loss of fillets with either moderate or severe WBC was significantly greater (P < 0.05) than that of normal samples. These results demonstrate that the effects of wooden breast condition on WHC vary with the methods used to measure meat WHC. Wooden breast condition increases cook loss of chicken breast fillets; however, it results in reduced thaw loss in frozen-thawed broiler breast fillets.

**Key Words:** Broiler breast meat, wooden breast condition, water-holding capacity, thaw loss, cook loss
sions of the Meullenet-Owens razor shear test. Both peak shear force (N) and total shear energy (N x mm) were measured. Each fillet was sheared in 7-8 locations both before and after cooking to an endpoint temperature of 78°C. In raw fillets, both BMORS and MORS values increased with the severity of the wooden breast condition (P < 0.01). After cooking, however, BMORS values were similar between wooden breast categories, but MORS values were greater (P < 0.0001) in moderate and severe wooden breast samples compared to normal fillets. For all fillets, regardless of the wooden breast score, MORS values were greater (P < 0.0001) following cooking compared to pre-cooked (raw) measurements. With BMORS measurements, however, cooking increased the shear values in normal samples but decreased the shear values in severe wooden breast fillets. For both the BMORS and MORS measurements, the peak shear force and total shear energy values followed similar trends with regards to the effects of cooking and the wooden breast condition. Results from this study demonstrate that the wooden breast condition adversely influences meat texture in the raw fillets, but suggest that the ability to objectively detect texture differences in cooked breast meat is strongly dependent upon the technique used.

Key Words: breast meat, broiler, meat quality, texture, wooden breast

M22 Can acceptable quality angel food cakes be made using pasteurized shell eggs? The effects of processing factors on functional properties of angel food cakes. Ajaypal Singh, David Geveke United States Department of Agriculture

Due to recent incidences of avian flu and Salmonella contamination, the market for pasteurized shell eggs is rapidly growing. One objection to using pasteurized shell eggs is the belief that they will produce unacceptable angel food cakes. In the present study, shell eggs were pasteurized using a hot water immersion process (56.7 °C for 60 min) and angel food cakes were made from the pasteurized egg white (PEW) as well as from unpasteurized raw egg white (REW) for comparison. Angel food cake meringues were made using three different mixer speeds (6 - low, 9 - medium and 12 - high mixer speed settings) and three different durations for each speed. When the same processing factors for REW were used for PEW, a very soft meringue was formed. Increasing the mixing time for PEW by 33% or more at speed 12 was required for the formation of a hard meringue which is required for acceptable angel food cake. Functional qualities like egg and meringue foaming were evaluated and correlated to angel food cake characteristics. Angel food cakes were compared in terms of cake volume, cake structure, texture profile and color. Higher egg foam volume led to higher meringue volume and correspondingly to a better angel food cake. The angel food cake prepared from PEW had a 10-15% smaller volume than the cake prepared from REW; although, REW made a darker colored cake than PEW. Texture profile analyses showed that angel food cakes made from PEW were 10% more firm and 20% less elastic than those from REW. Color analyses showed that there were significant differences in the crust color of cake between those made from REW and PEW; although, there was no significant change in the crumb color. It can be concluded that modifying the mixing conditions for PEW results in angel food cakes with excellent quality, thus overcoming an objection. It can be concluded that modifying the mixing conditions for PEW and REW; although, there was no significant change in the crust color of cake between those made from REW and PEW; although, there was no significant change in the crumb color. It can be concluded that modifying the mixing conditions for PEW results in angel food cakes with excellent quality, thus overcoming an objection.

Key Words: Angel food cake, Foaming properties, cake meringue, Pasteurized eggs, Mixing

M23 Recovery of consciousness in broilers following combined DC and AC stunning Dianna Bourassa1, Brian Bowker2, R. Buhr1 USDA-ARS, U.S. National Poultry Research Center, Poultry Microbiological Safety and Processing Research Unit; 2USDA-ARS, U.S. National Poultry Research Center, Quality and Safety Assessment Research Unit

Broilers in the United States are typically electrically stunned using low voltage-high frequency (12-38V, ≥400Hz) DC or AC water bath stunners and in the European Union broilers are electrocuted using high voltage-low frequency (50-150V, 50-350Hz) AC. DC stunned broilers regain consciousness in the absence of exsanguination and AC stunned broilers die due to cardiac fibrillation. Questions regarding the status of consciousness of stunned broilers during exsanguination using US DC systems have been raised. This work evaluated an alternative stunning method adding an AC stun after DC stun and recovery of consciousness was determined. On two processing days, 85 individual broilers (1,950 g) and 120 broilers in groups of 5 were divided into 4 treatment stun groups: 15V DC+100V AC, 25V DC+100V AC, 15V DC+120V AC, and 25V DC+120V AC. For each treatment, shackled broilers were stunned with DC for 10 s in a water bath brine stunner immediately followed by AC for 5 s on a stunning plate. During stunning, maximum mA for both DC and AC stuns were recorded. Following stunning broilers remained shackled for 2 min at which time the ability to recover consciousness was assessed. When broilers did not recover, deep breast muscle pH was measured. Individual broilers DC stunned at 15V or 25V averaged 19 mA or 35 mA, respectively. During AC stunning at 100V or 120V the currents recorded were 101 mA or 133 mA, respectively. When broilers were stunned individually only 4 of 85 broilers were able to recover consciousness (2 at 25V DC+100V AC, 1 at 15V DC+120V AC, and 1 at 25V DC+120V AC). However, for 3 of the 4 broilers that recovered the mA recorded during the AC stun was only 43-51% of the average mA recorded, indicating a possible issue with stunning plate contact. Only one broiler stunned at 25V DC+100V AC with mA within the standard deviation was able to recover. When broilers were stunned in groups of 5, no broilers recovered in any of the treatment groups. No significant differences were detected in deep breast muscle pH (6.55 ± 0.19). These data indicate that stunning parameters combining DC and AC stunning may be a viable alternative to currently utilized protocols. Further work assessing effects of the addition of AC stun on carcass and meat quality will be assessed.

Key Words: broiler, stunning, consciousness, direct current, alternating current

M24 Novel pod for chlorine dioxide generation and delivery to control aerobic bacteria on the inner surface of floor drains Mark Berang1, Mark Harrison2, Richard Meinersmann1 USDA-Agricultural Research Service; 2University of Georgia

Floor drains in poultry processing and further processing plants are a harborage site for bacteria both free swimming and in biofilms. This population can include Listeria monocytogenes which has been shown to have potential for airborne spreading from mishandled open drains. Chlorine dioxide (ClO2) is a proven antimicrobial agent with activity against a wide variety of bacteria. Recently, simple and cost effective onsite chlorine dioxide generation products in the form of a compact plastic pod containing chemical precursors for gaseous ClO2 have entered the market for cleaning and deodorization applications. The objective of this study was to test commercially available ClO2 pods as a means to sanitize floor drains. The inner surface of floor drains were sampled in two equal halves each half being 180° of the cross section along the entire vertical length. On each of two replicate sample days, half of the inner surface 5 floor drains were sampled prior to treatment with a sponge pre-moistened with DE neutralizing broth. Each drain was treated by placing an activated pod face down into the drain and allowing 4 hours for ClO2 gas to settle through the pipe. Then, the second half of the inner surface of the pipe was sampled. Fifty additional mL DE broth was added to each sponge which were stomached; serial dilutions were plated on plate count agar, incubated at 35°C for 24 hours and resulting colonies counted. Colony numbers were log transformed and counts before and after treatment were compared by Student's T-test. A mean of 6.5 log CFU/mL DE broth was detected per drain sample prior to application of the treatment, 0.5 log CFU/mL was detected after treatment (P < 0.01). No difference (P = 0.35) was noted between half pipe samples taken before and after the same time period in untreated control pipes. Pre-mixed ClO2 pods show potential as a means to sanitize floor drains.

Key Words: Chlorine dioxide, floor drains, aerobic bacteria
M25 On-line pollution load control to lower chemical and energy costs of i-DAF as pre-treatment for slaughterhouse wastewater Hendrik Menkveld1, Scott Christian2, Eddie Broeders3 ‘Nijhuis Water Technology BV’, 2Nijhuis Water Technology Inc.

The TSS and COD concentration in wastewater during production hours at slaughterhouses varies throughout the day. In most cases, the chemical dosage for coagulation/floculation and the amount of aeration for dissolved air floatation (DAF) is based on treatment of the maximum peak load of pollution during the day, which results in a higher chemical dosage and energy consumption than necessary. Using on-line pollution load control with i-DOSE based on flow, TOC and pH measurement the overall chemical usage and energy consumption can be reduced by 15-30% and 15-25%, respectively. These reductions, considered to be significant, are provided by combining the new i-DOSE process control in combination with i-DAF as an optimized economic pre-treatment control that reduces the operational costs for wastewater treatment.

At two different meat processing plants, a fully automatic i-DOSE system was installed based on on-line flow measurement in combination with a new type of on-line TOC measurement. Based on these measurements the pollution load can be analysed and monitored continuously which allows real-time control over the chemicals required for optimal coagulation, neutralising and flocculation before the DAF unit. Additionally by determining the pollution load, the dry matter concentration of the produced sludge after DAF can be optimised and the amount of energy for aeration can be reduced.

Both installations have shown that with on-line pollution load control a reduction of FeCl3 (20%) and NaOH (40%) can be achieved. The energy consumption can also be reduced by 15-25% depending on size of i-DAF system and the dry matter content can be increased depending on type of installed DAF system. The i-DOSE system provides improved DAF stability and also better effluent quality, because over dosage of chemicals is avoided. A side effect of on-line pollution load control is that it has been proven to be a very successful tool for good housekeeping within the production itself.

In the full paper and presentation an overview of the new I-DOSE concept will be provided and highlight the reduction in operation costs for slaughterhouse wastewater (lower chemicals and energy consumption per m³ of wastewater and higher dry matter content). This will be done based on several pilot and full-scale installations were on-line pollution load measurement has been tested and implemented successfully.

Key Words: on-line pollution load control, i-DAF, chemical reduction, energy reduction, wastewater

M26 Fat recovery from dissolved air flotation sludge for energy production Hendrik Menkveld1, Nadine Boelee1, Scott Christian2 ‘Nijhuis Water Technology BV’, 2Nijhuis Industries Inc.

Industrial wastewaters with high concentrations of oil and grease in the food and meat processing industry are often treated by dissolved air flotation allowing for suitable discharge effluent quality and greatly reducing the pollutant load to municipal wastewater treatment plants. Typical wastewaters containing high concentrations of oil and grease include slaughterhouse wastewater from poultry and cattle slaughterhouses and processing plants. Treatment with dissolved air flotation results in a waste sludge product that contains a high fat content. While currently often disposed, this fat can also be recovered as a valuable product.

This proposed presentation will provide the audience with an overview of laboratory and full-scale applied research that investigates a novel treatment technique for fat recovery of dissolved air flotation sludge. During laboratory-scale investigation, 71 percent of the fat was recovered from slaughterhouse dissolved air flotation sludge, meanwhile further optimization of the process should result in excess of 90 percent recovery. The separation of fat and solids was found to be an important step in the fat recovery process.

A full-scale, a fat recovery system implemented at a bacon factory confirmed the potential of this novel treatment technique. The full-scale system recovered 6 m³ fat per day on average. Moreover, by utilizing 3 m³/d of this fat for energy production, the factory was fully self-sufficient in energy. The return on investment was less than 1.5 year. These proposed presentation will provide the audience with an overview of fat recovery techniques and how best to utilize is recovered value stream.

Key Words: DAF Sludge, Slaughterhouse wastewater, Fat recovery, Energy production, Biodiesel

M27 Poultry System Simulation Model to evaluate water consumption and wastewater contamination levels Olga Kemenova1, Alexander Samoylov1, Doug Britten2, Georgia Tech Research Institute

A poultry processing plant requires high quantities of potable water for its operation. It is estimated that a typical commercial broiler processing plant uses about 6.9 gallons of water per bird processed (GPB) on average, and for the most plants the water usage falls in the 5-10 GPB range. Furthermore, wastewater produced by Meat and Poultry Products (MPP) facilities contains sufficiently high concentrations of nutrients and contaminants that are harmful to human health and environment. The concentrations of nitrates and ammonia discharged by MPP industries have been shown to be toxic to aquatic life which contributes to the impairment of streams, rivers and lakes. The main objective of the present work is to deliver a modeling tool that would benefit researchers and managers in evaluating water usage at poultry processing plants.

The developed Poultry System Simulation Model centers on evaluation of water consumption and wastewater contamination levels (before and after water treatment) by simulating the water use and subsequent water treatment processes. The model components that simulate the water usage at poultry processing plant represent generic processes that describe poultry processing work and water flow. Because in practice each poultry processing plant is unique, the developed model has been designed to be easily adjustable to represent a particular production layout. Using monthly chicken production as an input the present model calculates contaminant concentrations in wastewater flow such as total suspended solids (TSS), biochemical oxygen demand (BOD), fats, oil and grease (FOG), total kjeldahl nitrogen (TKN) and phosphorus. The implemented wastewater module allows for all possible wastewater treatment components and mimics a general wastewater treatment facility. Depending on the needs of a particular facility and local requirements, the elements of the wastewater treatment system can be easily included or excluded from the simulation process. The wastewater module accounts for all major pollutants regulated by the U.S. EPA including BOD, TSS, TKN, FOG and phosphorus. The high level of customization allows users to evaluate design modifications in the production and water treatment processes before committing to actual building contracts and expenditures.

The preliminary results obtained have demonstrated good predictive capabilities of the present Poultry System Simulation Model, however, more research is needed to evaluate and validate the model further.

Key Words: modeling, water consumption, wastewater treatment