

INDUSTRY APPLICATION OF ELECTRICAL STIMULATION IN THE UNITED STATES

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INTRODUCTION

PROBABLY never before has there been a process go from a laboratory research problem to immediate acceptance in industry as fast as electrical stimulation. Benefits that were discovered by the use of electrical stimulation included improved tenderness, increased flavor, brighter lean color, increased set-up of marbling, less "heat-ring" development, reduced aging requirements and improved retail display characteristics. Although tenderness improvement was the primary reason that research was conducted on electrical stimulation at Texas A&M University, the other benefits found may have been more instrumental in the industry adoption of electrical stimulation than improving the tenderness of beef.

Because of the interest shown by the U.S. meat industry regarding the incorporation of electrical stimulation into the slaughter-dressing sequence of beef packing plants, three U.S. companies, LeFiell Company, San Francisco, CA, (a subsidiary of Cincinnati Butchers' Supply, Cincinnati, OH); Britton Manufacturing, College Station, TX (equipment sold and distributed by Koch Supplies, Kansas City, MO); and Omeco-St. John, Omaha, NE began building equipment to administer electricity to carcasses. Advertisements in the three largest meat trade magazines--National Provisioner, Meat Industry and Meat Processing--coupled with exhibits and displays at meat trade association conventions have led to a high packer awareness of the benefits associated with the use of electrical stimulation and to the availability of equipment to conform to almost any size operation.

INDUSTRY INTEREST IN ELECTRICAL STIMULATION

AS MENTIONED earlier, benefits other than tenderness obtained by the use of electrical stimulation have prompted many U.S. beef packers to incorporate this process. The effects of electrical stimulation on the quality-indicating characteristics of beef (Savell et al., 1979) suggests that the use of electrical stimulation for the improvement in these factors could be very beneficial--in financial terms--to beef packers. Since USDA beef quality standards are so dependent on the degree of marbling and the lean color, firmness and texture of the longissimus muscle and because the best evaluations of the longissimus muscle are made when complete glycolysis and full rigor mortis have occurred, electrical stimulation of beef carcasses results in these factors being at their optimum point at an early (19-24 hr postmortem) instead of a later time (48 hr postmortem). Electrical stimulation results in more beef carcasses being eligible for the U.S. Choice grade during the first day postmortem and sharply reduces the number of carcasses that have to be held two days or more waiting for these quality-indicating characteristics (especially marbling) to fully develop. Research by Calkins et al. (1980) has suggested that electrical stimulation does not result in beef carcasses receiving higher-than-justified grades; in fact, chilling for 48 hr or more before exposing and evaluating the longissimus muscle from nonstimulated (control) sides was considered more desirable in attaining the highest scores for the quality-indicating characteristics (although from a time standpoint this practice would not be practical for most U.S. beef packers).

COMMERCIAL EQUIPMENT

THE FIRST U.S. beef slaughterer to fully utilize electrical stimulation was H and H Meat Products, Mercedes, TX (Savell, 1978). After a week of conducting field studies in their plant during April 1978, Texas A&M University research scientists were persuaded to leave their prototype electrical stimulator (experimental "Lectro-Tender"™ manufactured by the LeFiell Company) by H and H Meat Products management for further testing. With the subsequent purchase and installation of an electrical stimulator after several months of using the prototype unit, electrical stimulation has become an integral part of the H and H Meat Products production scheme.

LeFiell Company, in November 1978, became the first company to install a fully automated electrical stimulator in a beef packing plant in the United States. Sam Kane Beef Processors of Corpus Christi, TX, with a slaughter capacity of 107 head/hr, installed the first "Lectro-Tender"™ (model #4051). Early in 1979, the LeFiell Company installed the first "Continuous-Trac Lectro-Tender"™ (model #4055) in Litvak Meat Company, Denver, CO. The development of the "Continuous-Trac Lectro-Tender"™ was a significant accomplishment since this electrical stimulator allows for the application of electricity to carcasses up to a rate of 300 head/hr.

Commercially available electrical stimulators are being built for beef packing plants with slaughter capabilities of 10 head/day to 30 head/hr. Electrical stimulators are of two basic types: (1) manually-inserted probe-type for beef packers with capacities up to 50 head/hr (Britton Manufacturing), and (2) fully-automated bar- or conveyor-types for beef packers with capacities of 50 head or more/hour (LeFiell Company and Omeco-St. John). Each manufacturer has certain design features which serve as selling points for their equipment.

ELECTRICAL PARAMETERS

PRIMARILY based on the results of McKeith et al. (1980), the electrical parameters used by the manufacturers of commercial electrical stimulators are almost identical. Most electrical stimulation equipment has the following electrical parameters: 550-600 volts (AC); 5-15 amps; 60 cycles per second; 15-20 impulses of electricity with a duration of 2.0 sec and an interval between impulses of 1.0 sec.

INSTALLMENT OF EQUIPMENT

ELECTRICAL stimulation is being administered to beef carcasses at many different points in the slaughter-dressing sequence: MBPXL Corporation, Plainview, TX is electrically stimulating immediately after bleeding; Litvak Meat Company, Denver, Co is electrically stimulating prior to complete hide removal; Sam Kane Beef Processors, Corpus Christi, TX is electrically stimulating immediately prior to evisceration; and Freedman Packing Company, Houston, TX is electrically stimulating immediately after evisceration. Research by McKeith et al. (1980) has proven that the benefits associated with the use of electrical stimulation can be attained by applying electrical stimulation at any point in the slaughter-dressing sequence. This finding is very important to meat packers wishing to use this process from the standpoint that almost all electrical stimulation equipment is being installed in existing plants which have limited room for expansion of slaughter floor functions.

SAFETY ASPECTS

ALL INSTALLATIONS of electrical stimulation equipment in USDA inspected slaughter plants have to be approved by USDA Meat and Poultry Inspection Program facilities personnel for compliance with safety specifications. These specifications call for flashing red lights and warning signs designed to alert workers in the area of possible danger as well as the installment of a partial enclosure (except for carcass entrance and exit) around electrical stimulation equipment. So far, no reports of any serious worker injury due to electrical stimulation has been reported which is a tribute to the designed safety features of the equipment and the strict safety measures enforced by the USDA.

INDUSTRY ADOPTION OF ELECTRICAL STIMULATION

MANY beef plants have begun to use electrical stimulation to improve the quality and palatability of beef. Articles by Savell et al. (1979); Savell and Smith (1979), Savell (1978) and Morris (1979) refer to the names and locations of many of the beef packers using this process. At the present time three of the top beef packers in the United States--Iowa Beef Processors, MBPXL Corporation and Monfort--are using electrical stimulation in some of their packing plants. The largest packing plant to date to use electrical stimulation is the new MBPXL Corporation plant in Dodge City, KS. This new plant has a slaughter capacity of 4000 head/day and uses a "Continuous-Trac Lectro-Tender" to administer the electrical stimulation.

Although electrical stimulation is far from being incorporated on a nationwide basis, several states--Texas, Colorado and California--have many beef slaughter plants using this process. Electrical stimulators can be found in almost half of the states of the nation with commercial adoption becoming more widespread each month. It is felt by those persons manufacturing electrical stimulation equipment that industry-wide acceptance of this process in the United States for beef is certain and that the potential for distribution of this equipment to countries outside the United States is unlimited.

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