A Rating system for oyster purification Hazard analysis critical control point (HACCP) application to purification of live oysters

Système de classement pour la purification des huîtres Application de la méthode d'analyse HACCP à la purification d'huîtres

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Abstract

A Critical Hazard Analysis Rating (CHAR) based on the Hazard Analysis Critical Control Point (HACCP) concept is used to monitor oyster purification in New South Wales (NSW), Australia. Critical areas for assessment include oyster condition, separation of raw and treated oysters, water quality (turbidity, salinity, temperature, aeration, circulation), purification period, flow rate, steriliser efficiency and tank hydraulics. Batch records and product identification are included.

Purification supplements a total management program for producing safe oysters. The rating can also be used to endorse oysters produced under industry self-regulatory, quality assurance programs.

The four main CHAR areas are operational standards, quality assurance, public health safety of oysters and public health safety of growing areas. Operational standards are also rated in "point" to provide an objective method for determining improvement, stability or lowering of purification plant standards.

These critical areas have been used to classify six CHAR levels (0-5 stars), with rules existing for switching levels.

The star rating is used by the NSW Health Department to determine priorities for monitoring purification plants and provides a guide only to the operational standards of plants at this stage but has potential for complementing industry self-regulatory programs embracing quality assurance and the public health safety or oysters and growing areas.

Keywords: Oysters, purification, HACCP, *Saccostrea commercialis, Crassostrea gigas.*

Résumé

En Nouvelles-Galles du Sud en Australie, on utilise, pour contrôler la purification des huîtres, le classement CHAR (Critical Hazard Analysis Rating) fondé sur le concept HACCP des points critiques d'analyse de risque. Les domaines critiques d'évaluation incluent l'état des huîtres, la séparation entre huîtres crues et traitées, la qualité de l'eau (turbidité, salinité, température, aération, circulation), la période de purification, le débit d'eau, l'efficacité du stérilisateur et l'hydraulique des réservoirs. L'analyse porte également sur l'historique des lots et l'identification des produits.

La purification sert de complément à un programme de gestion globale pour la production d'huîtres saines. Le classement peut également s'utiliser pour certifier des huîtres produites dans le cadre de programmes d'assurance qualité auto-régulés par l'industrie ostréicole.

Les quatre principaux domaines d'intérêt du classement CHAR concernent les normes d'exploitation, l'assurance qualité, la salubrité des huîtres à la consommation et la salu-

brité des zones d'élevage. Les normes d'exploitation sont également classées par « point » pour obtenir une méthode objective permettant de déterminer l'amélioration, le maintien ou l'abaissement éventuels des normes concernant les stations de purification.

Ces domaines critiques sont utilisés pour définir les six niveaux de classement CHAR (de 0 à 5 étoiles) et les règles déterminant le passage d'un niveau à un autre.

Le classement par étoile est utilisé par le ministère de la Santé en Nouvelles-Galles du Sud pour définir les priorités de contrôle des installations de purification. A ce stade, il permet uniquement de guider les normes d'exploitation des stations, mais présente de bonnes possibilités en tant que complément aux programmes d'assurance qualité auto-régulés par l'industrie, pour assurer la salubrité des huîtres et des zones d'élevage.

Mots-clés : Huîtres, purification, HACCP, *Saccostrea commercialis, Crassostrea gigas.*

Public health implications

On occasions, some oyster harvest areas in New South Wales (N.S.W.), Australia, are temporarily polluted, presenting a likely danger to public health unless adequate control measures are taken.

The filter-feeding activity of oysters allows accumulation and concentration of any disease causing agents present in harvesting areas thereby providing a route for transmission of disease from polluted waters to man.

Whilst the number of food poisoning outbreaks attributed to oyster consumption in N.S.W. is very small, there is a potential for further outbreaks. In such cases there is an immediate reduction of consumer confidence and a detrimental, economic impact on the oyster industry.

In order to protect public health and enhance the integrity of the oyster industry, the N.S.W. Health Department has statutory powers under the Food Act 1989, to control the sale of oysters in its state. These regulations include compulsory purification of oysters prior to sale in controlled treatment plants.

Purification process

Purification is a controlled process using only sterilised sea water to allow live, filter-feeding shellfish to purge themselves naturally of most micro-organisms they may have accumulated from the environment and provides an additional barrier to the likely transmission of disease causing agents from oysters to man.

Hazard analysis critical control point (HACCP) concept

The HACCP procedure can be used as a preventive tool of public health control to identify critical components of a food processing operation which must be strictly controlled to ensure the food complies with end-product standards.

Hazard analysis assesses and identifies particular stages within a food processing operation where the food can be contaminated or fail to be satisfactorily treated. Critical control points are processes which if not properly controlled may lead to the end-product posing a risk to public health (West P.A., 1986).

The concept is becoming increasingly important from both a production and administration viewpoint for a range of fresh and processed foods.

It has been established that effective oyster purification requires control of certain physical parameters for optimum shellfish filtration and adequate water quality (Souness R.A., G.H. Fleet, 1979). For oyster production, HACCP must take into account these requirements together with the likely level of micro-organisms in the raw product and hygienic conditions for treatment. Correct product handling after treatment and identification of product source are necessary to correctly identify particular batches for effective quality control and to ensure proper handling. A Flow Process Chart and Hazard Audit Table (West P.A., 1986; Department of Primary Industries and Energy, 1989) indicating critical operations, potential risks, critical control points, preventive control and monitoring procedures, and corrective action have been prepared (Bird P.D., 1991a) and provide a suitable base on which to formulate quality control procedures for management and regulatory agencies alike.

Critical hazard analysis rating (CHAR)

A rating (CHAR) based on the HACCP concept with public health orientation, has been designed for the practical application of the HACCP system in monitoring oyster purification in NSW, Australia.

Critical elements (30) have been rated depending upon their degree of hazard. Weighting favours the more critical hazards such as oyster filtration rather than the less critical ones such as the provision of a thermometer.

Critical elements (points for each follow in parenthesis) are: oyster condition (300), turbidity (285), salinity (260), temperature (230), circulation system (215), separation of raw and treated product (200), purification period (200), exchange rate (190), oyster cleanliness (180), aeration (170), double-layering (160), likely contamination (160), temperature protection pre and post purification (150), tank hydraulics (130), steriliser sleeve cleanliness (130), steriliser flow rate (115), oysters above faeces layer (110), oyster layout (100), germicidal lam efficiency (100), product labelling (100), operational batch records (80), oyster washing area (75), oyster density (70), plant sanitation (70), steriliser design (40), hydrometer present (30), thermometer present (25), construction of plant and fittings (20), availability of records (20) and toxic plumbing (10).

These critical elements have been categorised into the following groups to simplify the assessment : water quality, oyster quality, plant design, operational standards, hygiene, records/product identification and construction (Table I).

Codes of practice (National Health and Medical Research Council, 1987; New South Wales Health Department, 1991) require compliance with these elements and specific information about each is addressed in a booklet (Bird P.D., 1991b) supplied by the N.S.W. Health Department to each plant operator.

As purification is only one part of an overall oyster management program (Bird P.D., 1990), the rating can be extended to include additional quality assu-

rances such as industry self-regulation of oyster quality; monitoring oysters and growing areas for faecal bacteria, heavy metals, pesticides and marine biotoxins; and environmental contamination, particularly sewage treatment plant outfalls.

Classification

There are four main CHAR areas. i.e. operational standards, quality assurance, public health safety of oysters and public health safety of growing areas. These CHAR areas have been classified into six levels (0 to 5 stars *) and rules exist for switching levels. Switching rules are based on immediate de-rating following a defect which compromises the public health safety of the end-product and advancement to higher ratings following a period of consolidation where defect rectification has been demonstrated.

Operational standards are based on existing evidence that plants of a standard design and operated to standard procedures will purify oysters effectively. The rating uses a "point" system providing an objective method for monitoring improvement, stability or lowering of purification plant standards. i.e.

0★

Low level of operational standard and compliance with recognised codes.
Oysters are not purified effectively in conformity with recognised codes.
Batch records and labelling do not adequately identify product source or provide information to ensure optimum handling and storage of oysters (table I).
(Purification plant has not been classified).

1★

Average level of operational standard and compliance with recognised codes.
Oysters are purified effectively in conformity with recognised codes.
Batch records and labelling adequately identify product source and provide information to ensure optimum handling and storage of oysters (table I).

Table I : Critical element groups for plant operational standards showing their respective rating (points) for various (CHAR) star levels. (Levels 3★, 4★ and 5★ are the same as level 2★)

Rating (points) Critical element	Max.	0★	1★	2★
Water quality	1135	< 990	≥ 990	≥ 990
Oyster quality	1070	< 1010	≥ 1010	1010
Plant design	945	< 760	760-944	≥ 945
Operational standards	750	< 750	750	750
Hygiene	285	< 260	260-284	285
Records/product identification	200	< 200	200	200
Construction	40	< 31	31-39	40

2★

High level of operational standard and compliance with recognised codes.

Oysters are consistently purified effectively in conformity with recognised codes.

Batch records and labelling adequately identify product source and provide information to ensure optimum handling and storage of oysters (table I).

3★

Compliance with 2★.

The plant operator has participated in an approved basic oyster quality assurance program (QAP) for at least 6 months. (The basic QAP includes an early warning system for accidental pollution of oyster growing areas; a local group to manage the QAP and monitor critical parameters for harvesting and purification; and an effective communication system amongst farmers).

4★

Compliance with 3★.

There are non documented cases of food poisoning associated with local oysters for the previous 5 years.

Purified oysters are tested for *Escherichia coli* (>12 samples/year) especially during periods when oysters are likely to be adversely affected such as after heavy rainfall.

Samples meet Australian bacterial standards (Standards Association of Australia., 1976a) and no unsatisfactory results have been found in the previous 2 years.

5★

Compliance with 4★.

Water and/or oysters in each harvest area are tested monthly (>12 samples/year) for *E. coli.*

Water and/or oysters in each harvest area are tested monthly (>12 samples/year) for heavy metals, pesticides and marine bio-toxins.

There is no evidence in oysters of heavy metals, pesticides or marine biotoxins in levels exceeding acceptable standards.

Samples meet Australian bacterial standards (Standards Association of Australia, 1976a, 1976b).

There are no sewage treatment plant outfalls into oyster growing areas.

Rules

All plants start at 0★ until inspected. The plant must be operating during the inspection. Inspections can be made either at random or on notice but must be carried out at least annually to maintain the current CHAR level.

Switching rules

0★ to 1★

Immediately following satisfactory inspection.

1★ to 2★

Compliance with 1★ and ;

12 months following satisfactory inspection(s).

Following de-rating to level 0★ or 1★, advancement to level 2★ follows a consolidation period of at least 12 months.

2★ to 3★

Compliance with 2★ and ;

Participation in an approved QAP for at least 6 months.

3★ to 4★

Compliance with 3★ and ;

No history of food poisoning cases for 5 years and ;

Minimum number oyster samples (>12/year) tested for *E. coli* over at least 2 years and ;

Test results satisfactory.

4★ to 5★

Compliance with 4★ and ;

Minimum number water/oyster samples from harvest areas tested for *E. coli* (>12/year), heavy metals (>1/year), pesticides (>1/year) and marine bio-toxins (>1/year) over at least 2 years and ;

No sewage treatment plant outfalls into oyster growing areas as determined by an environmental survey.

De-rating rules

Immediate de-rating from any level to 0★ occurs when either a single test result on marketed purified oysters is unsatisfactory or the purification permit is cancelled.

5★ to 4★

Inadequate sampling or ;

Detection of heavy metals, pesticides or marine bio-toxins in levels exceeding recognised standards or ;

Sewage treatment outfall into growing areas.

5★ or 4★ to 3★

Documented case of food poisoning or ;

Inadequate sampling or ;

Unsatisfactory test results.

5★, 4★ or 3★ to 2★

Non-participation in QAP for more than 1 month.

5★, 4★, 3★ or 2★ to 1★

Average level of operational standard.

5★, 4★, 3★, 2★ or 1★ to 0★

Low level of operational standard.

All de-ratings are effective immediately.

Application

The CHAR system can be used for reporting on purification plant assessments and because it is computerised, the rating can be determined in the field immediately and overall data analysed enhancing management of the New South Wales Oyster Program, (Bird P.D., 1990). The star rating is used by the NSW Health Department in determining priorities for monitoring purification plants and provides a guide only to the operational standards of plants at this stage.

The use of such ratings also has potential for complementing industry self-regulatory programs embracing quality assurance and the public health safety of oysters and growing areas.

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