

Chapter 14: Coliforms, Fecal Coliforms and *Escherichia coli*

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Potential Food Safety Hazard

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Coliforms

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Coliforms are Gram-negative, rod-shaped facultatively anaerobic bacteria. Identification criteria used are production of gas from glucose (and other sugars) and fermentation of lactose to acid and gas within 48 h at 35°C (Hitchins et al., 1998).

The coliform group includes species from the genera *Escherichia*, *Klebsiella*, *Enterobacter*, and *Citrobacter*, and includes *E. coli*. Coliforms were historically used as indicator microorganisms to serve as a measure of fecal contamination, and thus potentially, of the presence of enteric pathogens in fresh water. Although some coliforms are found in the intestinal tract of man, most are found throughout the environment and have little sanitary significance (Greenberg and Hunt, 1985).

The presence of large numbers of coliforms in foods is highly undesirable, but it would be almost impossible to eliminate all forms (Jay, 1978). Because they are easily killed by heat, coliform counts can be useful when testing for post-processing contamination of cooked fish and fishery products.

Fecal coliforms

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Because coliform counts are inadequate to differentiate between fecal and nonfecal contamination, a fecal coliform test was developed. Fecal coliforms are coliforms that ferment lactose in EC medium with gas production within 48 h at 45.5°C. With all shellfish isolates, an incubation temperature of 44.5°C (rather than 45.5°C) is used. Fecal coliforms are considered to be more directly associated with fecal contamination from warm-blooded vertebrates than are other members of the coliforms. *E. coli* usually makes up 75-95% of the fecal coliform count in shellfish growing areas, but at times can represent less than 1% of the coliform count (APHA, 1970; Greenberg and Hunt, 1985; Paille et al., 1987).

E. coli

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E. coli are naturally found in the intestinal tracts of all warm-blooded animals, including humans. Most forms of the bacteria are not pathogenic and serve useful functions in the intestine. Pathogenic strains of *E. coli* are transferred to seafood through sewage pollution of the coastal environment or by contamination after harvest. *E. coli* food infection causes abdominal cramping, water or bloody diarrhea, fever, nausea and vomiting (Ward et al., 1997).

Some *E. coli* strains may be only weakly lactose-positive (delayed lactose fermentation) or even lactose-negative (APHA, 1970; Ewing, 1986).

Enterovirulent *E. coli* (EEC) strains include several major subgroups:

Enterohemorrhagic *E. coli* (EHEC) causes hemorrhagic colitis and hemolytic uremic syndrome. Six verotoxins have been identified within this group, but only stx-1 and stx-2 seem to be important in human infections. *E. coli* O157:H7 is the principle serotype of this group (Reed, 1994).

Enteroinvasive *E. coli* (EIEC) causes a diarrheal illness similar to shigellosis (Reed, 1994).

Enterotoxigenic *E. coli* (ETEC) is a major cause of travelers' diarrhea and infant diarrhea in developing countries. These strains product a heat-labile toxin (LT) and/or a heat-stable toxin (ST) (Reed, 1994).

Enteropathogenic *E. coli* (EPEC) is an important cause of infant diarrhea (Reed, 1994).

Enteroadherent *E. coli* (EAEC) is a newly added category and not fully characterized (Hitchins et al., 1998).

Some properties of enterovirulent *E. coli* (EEC) subgroups are presented in the table below (Hitchins et al., 1998). For a full discussion, consult one of the recent reviews (DuPont et al., 1971;Levine, 1987).

Some properties of the enterovirulent *E. coli* (EEC) subgroups (Hitchins et al., 1998)^a

Property	ETEC	EPEC	EHEC	EIEC
Toxin	LT/ST ^b	Verocytotoxin (endogenous)	Verocytotoxin	-
Invasive	-	-	-	+
Stool	Watery	Watery, bloody	Watery, very bloody	Mucoid, bloody
Fever	Low	+	-	+
Fecal leukocytes	-	-	-	
Intestine involved	Small	Small	Colon	Colon, lower small
Serology		Infantile types	O157:H7 & a few other serotypes	

I _D ^c	High	High	Low	Low
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^aInformation on EAEC not yet available.

^bLT, labile toxin; ST, stable toxin.

^cI_D, infective dose

Control Measures

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Hazards from *E. coli* can be prevented by: heating seafood sufficiently to kill the bacteria, holding chilled seafoods below 4.4°C (40°F), preventing post-cooking cross-contamination and prohibiting people who are ill from working in food operations. The infective dose of *E. coli* is dependent upon the particular strain, from only a few organisms to millions. For this reason, time/temperature abuse of food products may or may not be necessary to result in illness (Ward et al., 1997).

Guidelines

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[FDA and EPA safety levels in Regulations and Guidance](#)

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Product	Guideline	Reference
Crabmeat, fresh and frozen	MPN of at least 3.6 per gram (IMVIC confirmed) in one or more of a minimum of 6 subsamples and inspectional evidence indicating the most probable source of the <i>E. coli</i> .	FDA, 1996b
Shrimp, raw breaded	Mean log of 16 units of finished product breaded shrimp collected prior to freezing is greater than 0.56 (i.e., geometric mean greater than 3.6/g) and exceeds the mean log of 16 units of stock shrimp by more than twice the standard error of their difference (2 SED).	FDA, 1996a

State Guidelines

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State Guidelines for coliforms, fecal coliforms and *E. coli*.

State	Products	Maximum Fecal coliforms (MPN)	Maximum <i>E. coli</i> (MPN)
Alabama	Oysters, fresh or frozen	230/100g	230/100g
Alaska	Oysters, clams, mussels Oysters, clams, mussels (eviscerated)	230/100g 100/100g	- -
Arizona	Clams, mussels, oysters	230/100g	230/100g
Arkansas	-	-	-
California	Oysters, clams, mussels	230/100g	-
Colorado	Oysters, clams, mussels, and scallops	230/100g	230/100g
Connecticut	Oysters, clams, mussels	230/100g	-

Delaware	Clams, mussels, oysters, or other mollusks, fresh or frozen	230/100g	-
Florida	Shellfish	230/100g	-
	Blue crab	-	50/100g
Georgia	Clams, mussels, oysters, fresh or frozen	230/100g	-
	Scallops: fried, frozen; breaded, frozen	50/g	-
	Crabmeat, cooked, fresh	100/g	-
	Deviled crab: frozen, cooked; fresh, uncooked	50/g	-
	Shrimp, peeled, cooked	20/g	-
	Shrimp, breaded, frozen, raw	1,100/g	-
	Fish, frozen, breaded, fried	10/g	-
	Fish, frozen, breaded, raw	100/g	-
Hawaii	Oysters, clams, mussels, fresh or frozen	230/100g	-
Idaho	-	-	-
Illinois	-	-	-
Indiana	-	-	-
Iowa	-	-	-
Kansas	-	-	-
Kentucky	Oysters, clams, scallops, shrimp, fresh or frozen	230/100g	-
Louisiana	-	-	-
Maine	-	-	-
Maryland	Oysters, clams, mussels, fresh or frozen	230/100g	-
	Crabmeat, fresh	-	36/100g
	Crabmeat, pasteurized	-	0
Massachusetts	Oysters, clams, mussels, fresh or frozen	230/100g	-
Michigan	-	-	-
Minnesota	-	-	-
Mississippi	Oysters, clams, mussels, fresh or frozen	230/100g	10,000/g enterotoxigenic
Missouri	Oysters, clams, mussels, fresh or frozen	230/100ml	-
	Foods	500/g	Negligible
Montana	-	-	-
Nebraska	Oysters, clams, mussels, fresh or frozen	230/100ml	-

	Deli foods (shrimp salad, etc.)	100/g	10/g
Nevada	-	-	-
New Hampshire	Oysters, softshell clams, fresh or frozen	230/100g	-
New Jersey	Oysters, clams, mussels, fresh or frozen	230/100g	-
	"Potentially hazardous" (tuna, shrimp salad)	100/g	0
New Mexico	-	-	-
New York	-	-	-
North Carolina	Shellfish	-	230/100g
	Crustacea, fresh	-	36/100g
	Crustacea, pasteurized	-	0
North Dakota	-	-	-
Ohio	-	-	-
Oklahoma	-	-	-
Oregon	Oysters, clams, mussels, fresh or frozen	230/100g	-
Pennsylvania	-	-	-
Rhode Island	Oysters, clams, mussels, fresh or frozen	230/100g	-
South Carolina	Blue crab, fresh, cooked	93/100g	46/100g
	Blue crab, pasteurized	-	0
	Oysters, clams, mussels, fresh or frozen	-	230/100ml
South Dakota	-	-	-
Tennessee	-	-	-
Texas	Crabmeat	50/g (in 20% or more of samples)	3.6/g (in 10% or more of samples)
	Oysters, clams, mussels, fresh or frozen	230/100g	-
Utah	-	-	-
Vermont	-	-	-
Virginia	-	-	-
Washington	Molluscan shellfish (Oysters, clams, mussels, fresh or frozen)	230/100g	-
West Virginia	Deli items (seafood salads)	100/g	<3/g
Wisconsin	-	-	-
Wyoming	-	-	-

(NFI, 1998)

ICMSF Recommended Microbial Limits

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Recommended microbiological limits for *E. coli* in fish (ICMSF, 1986).

Product	n ¹	c ²	Bacteria/g or cm ²	
			m ³	M ⁴
Fresh and frozen fish and cold-smoked fish	5	3	11	500
Precooked breaded fish	5	2	11	500
Frozen raw crustaceans	5	3	11	500
Frozen cooked crustaceans	5	2	11	500
Cooked, chilled, and frozen crabmeat	5	1	11	500
Fresh and frozen bivalve molluscs	5	0	16	-

¹Number of representative sample units.

²Maximum number of acceptable sample units with bacterial counts between m and M.

³Maximum recommended bacterial counts for good quality products.

⁴Maximum recommended bacterial counts for marginally acceptable quality products.

Plate counts below "m" are considered good quality. Plate counts between "m" and "M" are considered marginally acceptable quality, but can be accepted if the number of samples does not exceed "c." Plate counts at or above "M" are considered unacceptable quality (ICMSF, 1986).

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Growth

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[Table #A-1. Limiting conditions for pathogen growth.](#)

Heat Resistance

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Heat resistance of *E. coli* O157:H7.

Temp.		D-Value (min.)	Medium	Reference
(°C)	(°F)			
57.2	135	270	Ground beef	Padhye and Doyle, 1992
60.0	140	45	Ground beef	Padhye and Doyle, 1992
62.8	145	24	Ground beef	Padhye and Doyle, 1992
64.3	147.7	9.6	Ground beef	Padhye and Doyle, 1992

Analytical Procedures

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- [Enumeration of Escherichia coli in foods by the hydrophobic grid-membrane filter \(HGMF\) method \(HC MFHPB-26\)](#) [Top](#)
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- [Determination of coliforms in foods using violet red bile agar \(HC MFHPB-31\)](#) [Top](#)
- [Enumeration of E. coli and coliforms in food products and food ingredients using 3M™ Petrifilm™ E. coli plates \(HC MFHPB-34\)](#) [Top](#)
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- [Calculation of the most probable number of growth units for HGMF methods \(HC Appendix C\)](#) [Top](#)
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- [Procedure for the detection of verocytotoxin-producing Escherichia coli in food samples \(HC MFLP-89\)](#) [Top](#)
- [Identification of E. coli O157 by DynaBeads™ anti-E. coli O157 \(HC MFLP-90\)](#) [Top](#)
- [Detection of E. coli O157 by the Tecra™ E. coli O157 visual immunoassay \(VIA\) method and Tecra E. coli O156 Immunocapture \(HC MFLP-91\)](#) [Top](#)
- [Identification of Escherichia coli verotoxins by the Meridian Premier EHEC Kit™ \(HC MFLP-93\)](#) [Top](#)
- [The 20 hour Reveal method for detecting Escherichia coli O157:H7 from foods and environmental samples. \(HC MFLP-95\)](#)

[Top Enumeration of coliforms in foods and environmental samples using 3M™ Petrifilm™ high sensitivity coliform count \(HSCC\) plates \(HC 85\)](#)

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Other analytical procedures

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- Bacteria and coliform counts in dairy products: Dry rehydratable film methods (AOAC, 1995a)
- Bacteria and coliform counts in milk: Dry rehydratable film methods (AOAC, 1995b)
- Coliform and *Escherichia coli* counts in foods: Dry rehydratable film methods (AOAC, 1995c)
- Coliforms in dairy products: Pectin gel method (AOAC, 1995d)
- Confirmed total coliform and *E. coli* in all foods: Substrate supporting disc method (AOAC, 1995e)
- Detection of *Escherichia coli* producing heat-labile enterotoxin: DNA colony hybridization method (AOAC, 1995f)
- Enterotoxigenic *Escherichia coli*: DNA colony hybridization method using synthetic oligodeoxyribonucleotides and paper filters (AOAC, 1995g)
- *Escherichia coli* enterotoxins: Mouse adrenal cell and suckling mouse assays (AOAC, 1995h)
- *Escherichia coli* in chilled or frozen foods: Fluorogenic assay for glucuronidase (AOAC, 1995i)
- Fecal coliforms in shellfish growing waters: Medium A-1 method (AOAC, 1995j)
- Invasiveness of mammalian cells by *Escherichia coli*: Microbiological method (AOAC, 1995k)
- Total coliform and *Escherichia coli* counts in foods: Hydrophobic grid membrane filter/MUG method (AOAC, 1995l)
- Total coliforms and *Escherichia coli* in water: Defined substrate technology method (AOAC, 1995m)
- Total coliforms, fecal coliforms, and *Escherichia coli* in foods: Hydrophobic grid membrane filter method (AOAC, 1995n)

Commercial Test Products

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Commercial test products for coliforms.

Test Kit	Analytical Technique	Approx. Total Test Time ¹	Supplier
3M™ Petrifilm™ <i>E. coli</i> Count Plate ² [Used to enumerate <i>E. coli</i> and coliform bacteria]	An indicator of glucuronidase activity Dry rehydratable film method	24-48 h	3M Microbiology Products 3M Center, Building 275-5W-05 St. Paul, MN 55144-1000 Phone: 800/228-3957; 651/737-6501 E-mail: innovation@mmm.com
ColiComplete ² [Confirms total coliforms and <i>E. coli</i>]	Substrate supporting disc	48 h for coliforms 30 h for <i>E. coli</i>	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005

			Phone: 800/245-0113; 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com
ColiConfirm [Confirms presence of coliforms]	Substrate supporting disc	48 h	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 800/245-0113; 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com
Coliforms ²	Culture	24 h	Contamination Sciences LLC Contact: Robert Steinhauser 4230 East Towne Blvd., Suite 191 Madison, WI 53704 Phone: 608/825-6125 E-mail: bsteinha@contam-sci.com Web: www.contam-sci.com
ColiGel [For coliforms and <i>E. coli</i>]	Selective media, color indicator for galactosidase production (coliforms), UV fluorescence (<i>E. coli</i>)	28 h (coliforms) 48 h (<i>E. coli</i>)	Charm Sciences, Inc. 36 Franklin St. Malden, MA 02148-4120 Phone: 781/322-1523 E-mail: info@charm.com Web: www.charm.com
Colilert ^{®2} [For coliforms and <i>E. coli</i> in water samples; presence/absence]	Selective media with color indicator (UV light for <i>E. coli</i>)	24 h	IDEXX Laboratories, Inc. Contact: Greg Getchell One Idexx Dr. Westbrook, ME 04092 Phone: 207/856-0580 E-mail: greg-getchell@idexx.com Web: www.idexx.com/fed/home/start.asp
E*Colite [For presence/absence of coliforms and <i>E. coli</i> in water]	Selective media, color indicator for galactosidase production (coliforms) UV fluorescence (<i>E. coli</i>)	28 h (coliforms) 48 h (<i>E. coli</i>)	Charm Sciences, Inc. 36 Franklin St. Malden, MA 02148-4120 Phone: 781/322-1523 E-mail: info@charm.com Web: www.charm.com
ISO-GRID Method for Confirmed Coliform Count using LMG Agar ²	Membrane filtration with selective and differential culture medium based on lactose	24 h	Neogen Corporation 620 Leshner Pl. Lansing, MI 48912 Phone: 517/372-9200 E-mail: NeogenCorp@aol.com Web: www.neogen.com/isogridgen.htm

	fermentation		
PathoGel™ [A single assay that selectively grows, detects and quantitates coliform, <i>E. coli</i> and hydrogen sulfide producing Enterobacteriaceae]	Selective media, color indicator for galactosidase production (coliforms) UV fluorescence (<i>E. coli</i>), black precipitate (H ₂ S production)	28 h (coliforms) 28 h (fecal coliforms) 48 h (<i>E. coli</i>) 48 h (H ₂ S production)	Charm Sciences, Inc. 36 Franklin St. Malden, MA 02148-4120 Phone: 781/322-1523 E-mail: info@charm.com Web: www.charm.com
RCT™ Rapid Coliform Test	Redox reaction and color change	14 h	Applied Research Institute Contact: Trevor R. Hopkins 3N Simm Ln. Newton, CT 06470 Phone: 888/324-7900 E-mail: sales@arillc.com Web: www.arillc.com
SimPlate™ for Total Coliform and <i>E. coli</i>	MPN plate with selective media (UV light for <i>E. coli</i>)	24 h	IDEXX Laboratories, Inc. Contact: Greg Getchell One Idexx Dr. Westbrook, ME 04092 Phone: 800/321-0207; 207/856-0496 E-mail: greg-getchell@idexx.com Web: www.idexx.com/fed/home/start.asp
Total coliform/ <i>E. coli</i> (estimated)	Selective media with color indicator that changes based on approximate coliform count (UV light for <i>E. coli</i>)	30 min for 10 ⁸ 10 h for 10 ¹	Contamination Sciences LLC Contact: Robert Steinhauser 4230 East Towne Blvd., Suite 191 Madison, WI 53704 Phone: 608/825-6125 E-mail: bsteinha@contam-sci.com Web: www.contam-sci.com

¹Includes enrichment

²AOAC Approved

Commercial test products for *E. coli*

Test Kit	Analytical Technique	Approx. Total Test Time ¹	Supplier
3M™ Petrifilm™ <i>E. coli</i> Count Plate ²	An indicator of glucuronidase activity	24-48 h	3M Microbiology Products 3M Center, Building 275-5W-05 St. Paul, MN 55144-1000

[Used to enumerate <i>E. coli</i> and coliform bacteria]	Dry rehydratable film method		Phone: 651/737-6501; 800/228-3957 E-mail: innovation@mmm.com
CHECK 3 <i>E. coli</i>	Chemical, visual detection	4-18 h	Contamination Sciences LLC Contact: Robert Steinhauser 4230 East Towne Blvd., Suite 191 Madison, WI 53704 Phone: 608/825-6125 E-mail: bsteinha@contam-sci.com Web: http://www.contam-sci.com/
Coli ST EIA:ETC STA (Denka Seiken Co. Ltd).	EIA	18½ h	Oxoid, Inc. Contact: Jim Bell 217 Colonnade Rd. Nepean, Ontario K2E 7K3 Canada Phone: 613/226-1318 E-mail: jbelle@oxoid.ca
ColiComplete ² [Confirms total coliforms and <i>E. coli</i>]	Substrate supporting disc	30 h for <i>E. coli</i> 48 h for coliforms	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 800/245-0113; 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com
ColiGel [For coliforms and <i>E. coli</i>]	Selective media, color indicator for galactosidase production (coliforms), UV fluorescence (<i>E. coli</i>)	28 h (coliforms) 48 h (<i>E. coli</i>)	Charm Sciences, Inc. 36 Franklin St. Malden, MA 02148-4120 Phone: 781/322-1523 E-mail: info@charm.com Web: www.charm.com
Colilert ^{®2} [For coliforms and <i>E. coli</i> in water samples; presence/absence]	Selective media with color indicator (UV light for <i>E. coli</i>)	24 h	IDEXX Laboratories, Inc. Contact: Greg Getchell One Idexx Dr. Westbrook, ME 04092 Phone: 800/321-0207; 207/856-0496 E-mail: greg-getchell@idexx.com Web: www.idexx.com/fed/home/start.asp
<i>E. coli</i> ²	Culture	24 h	Contamination Sciences LLC Contact: Robert Steinhauser 4230 East Towne Blvd., Suite 191 Madison, WI 53704 Phone: 608/825-6125 E-mail: bsteinha@contam-sci.com Web: www.contam-sci.com
E*Colite [For presence/absence of coliforms and <i>E. coli</i> in water]	Selective media, color indicator for galactosidase production (coliforms) IIV	28 h (coliforms) 48 h (<i>E. coli</i>)	Charm Sciences, Inc. 36 Franklin St. Malden, MA 02148-4120 Phone: 781/322-1523 E-mail: info@charm.com

	fluorescence (<i>E. coli</i>)		Web: www.charm.com
GENE-TRAK <i>E. coli</i> Assay	Nucleic acid hybridization	28 h	Neogen Corporation 620 Leshar Pl. Lansing, MI 48912 Phone: 517/372-9200 E-mail: NeogenCorp@aol.com Web: www.neogen.com/isogridgen.htm
ISO-GRID Method for Confirmed <i>E. coli</i> Count using LMG Agar and BMA Agar ²	Membrane filtration with selective and differential culture medium based on lactose fermentation and β-γλυχυρονιδαση	24 h	Neogen Corporation 620 Leshar Pl. Lansing, MI 48912 Phone: 517/372-9200 E-mail: NeogenCorp@aol.com Web: www.neogen.com/isogridgen.htm
PathoGel™ [A single assay that selectively grows, detects and quantitates coliform, <i>E. coli</i> and hydrogen sulfide producing Enterobacteriaceae]	Selective media, color indicator for galactosidase production (coliforms) UV fluorescence (<i>E. coli</i>), black precipitate (H ₂ S production)	28 h (coliforms) 28 h (fecal coliforms) 48 h (<i>E. coli</i>) 48 h (H ₂ S production)	Charm Sciences, Inc. 36 Franklin St. Malden, MA 02148-4120 Phone: 781/322-1523 E-mail: info@charm.com Web: www.charm.com
SimPlate™ for Total Coliform and <i>E. coli</i>	MPN plate with selective media (UV light for <i>E. coli</i>)	24 h	IDEXX Laboratories, Inc. Contact: Greg Getchell One Idexx Dr. Westbrook, ME 04092 Phone: 800/321-0207; 207/856-0496 E-mail: greg-getchell@idexx.com Web: www.idexx.com/fed/home/start.asp
Total coliform/ <i>E. coli</i> (estimated)	Selective media with color indicator that changes based on approximate coliform count (UV light for <i>E. coli</i>)	30 min for 10 ⁸ 10 h for 10 ¹	Contamination Sciences LLC Contact: Robert Steinhauser 4230 East Towne Blvd., Ste. 191 Madison, WI 53704 Phone: 608/825-6125 E-mail: bsteinha@contam-sci.com Web: www.contam-sci.com
VET-RPLA	Reversed passive latex agglutination		Oxoid, Inc. Contact: Jim Bell 217 Colonnade Rd. Nepean, Ontario K2E 7K3 Canada Phone: 613/226-1318 E-mail: jbelle@oxoid.ca

¹Includes enrichment

²AOAC Approved

Commercial test products for *E. coli* O157:H7

Test Kit	Analytical Technique	Approx. Total Test Time ¹	Supplier
Assurance EHEC EIA [Used to detect <i>E. coli</i> O157]	Enzyme immunoassay	19½ h	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 800/245-0113; 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com
BAX [®] for Screening/ <i>E. coli</i> O157:H7	Polymerase chain reaction	21-24 h	Qualicon, Inc. P.O. Box 80357 Wilmington, DE 19880-0357 Phone: 800/863-6842; 302/695-9400 E-mail: info@qualicon.com Web: www.qualicon.com
Chromogenic O157 [A differentiation test for <i>E. coli</i> O157]		33-48 h	Biomedix Contact: Claver Bundac 1105 #F North Golden Springs Dr. Diamond Bar, CA 91765 Phone: 800/674-8648 #4282; 909/396-0244 E-mail: cb4biomedx@aol.com
Dynabeads [®] anti- <i>E. coli</i> O157	Immunomagnetic separation	24 h	Dynal Inc. Contact: Technical Service 5 Delaware Dr. Lake Success, NY 1042 Phone: 516/326-3270 E-mail: techserv@dynalusa.attmail.com Web: www.dynal.no
<i>E. coli</i> O157:H7 ²	Culture	24 h	Contamination Sciences LLC Contact: Robert Steinhauser 4230 East Towne Blvd., Suite 191 Madison, WI 53704 Phone: 608/825-6125 E-mail: bsteinha@contam-sci.com Web: www.contam-sci.com
<i>E. coli</i> O157 Latex Test			Oxoid, Inc. Contact: Jim Bell 217 Colonnade Rd. Nepean, Ontario K2E 7K3 Canada Phone: 613/226-1318 E-mail: jbelle@oxoid.ca
eclipse [™] <i>E. coli</i> O157:H7 Rapid Color Change Test [For	Immunoassay	8.33 or 20.33 h	Eichrom Technologies, Inc. Contact: Cara Tomasek 8205 South Cass Ave., Suite 111 Darien, IL 60561 Phone: 630/963-0320

identifying <i>E. coli</i> O157:H7 in food products, ingredients and water]			E-mail: info@eichrom.com Web: www.eichrom.com
EHEC-Tek™ [For <i>E. coli</i> O157:H7 in foods]	Magnetic capture and concentration/ELISA	24 h	Organon Teknika Corp. 100 Akzo Ave. Durham, NC 27712 Phone: 800/654-0331; 919/620-2000 E-mail: casey@orgtek.com
EIAFoss <i>E. coli</i> O157	Combination ELISA and Immuno Magnetic Separation	22-24 h	Foss North America, Inc. 7682 Executive Dr. Eden Prairie, MN 55344 Phone: 612/974-9892 E-mail: sales@fossnorthamerica.com Web: www.fossnorthamerica.com
ImmunoCard Stat! <i>E. coli</i> O157:H7	Immunoassay using colloidal gold	8-24 h	Meridian Diagnostics Technical Support 3471 River Hills Dr. Cincinnati, OH 45244 Phone: 513/271-3700 E-mail: techsupport@meridiandiagnostics.com
ISO-GRID Method for <i>E. coli</i> O157:H7 [Enumeration using SD-39 Agar]	Membrane filtration with selective and differential culture medium based on lysine decarboxylase, sorbitol fermentation and β-γλυχυρονιδαση	24-48 h (24 h for presumptive enumeration and 24 h additional to confirm presumptive positive results)	Neogen Corporation 620 Leshner Pl. Lansing, MI 48912 Phone: 517/372-9200 E-mail: NeogenCorp@aol.com Web: www.neogen.com/isogridgen.htm
NOW [For rapid detection of <i>E. coli</i> O157:H7]	Antibody	9 h	Contamination Sciences LLC Contact: Robert Steinhauser 4230 East Towne Blvd., Suite 191 Madison, WI 53704 Phone: 608/825-6125 E-mail: bsteinha@contam-sci.com Web: www.contam-sci.com
PATH-STICK One Step Rapid <i>E. coli</i> O157 Test	Immunochromatography	16-24 h	Celsis, Inc. Contact: Susan Moffa 165 Fieldcrest Ave. Edison, NJ 08837 Phone: 800/222-8260; 732/346-5100 E-mail: smoffa@celsis.com Web: www.celsis.com
Premier <i>E. coli</i> O157	ELISA	19 h	Meridian Diagnostics Technical Support 3471 River Hills Dr. Cincinnati, OH 45244 Phone: 513/271-3700

			E-mail: techsupport@meridiandiagnostics.com
Probelia PCR System [Used to detect <i>E. coli</i> O157:H7]	Polymerase chain reaction	24 h	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 800/245-0113; 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com
Reveal [®] Microbial Screening Test for <i>E. coli</i> O157:H7	Sandwich ELISA	8 h	Neogen Corporation 620 Leshar Pl. Lansing, MI 48912 Phone: 517/372-9200 E-mail: NeogenCorp@aol.com Web: www.neogen.com/revealecoli.htm
RIDASCREEN Verotoxin [Used to detect <i>E. coli</i> VT1 and VT2]	ELISA	10-18 h	Lionheart Diagnostics Contact: Thomas Grace Box 998, Highland Park Winooski, VT 05404-0998 Phone: 802/655-4740 E-mail: RbioST@voyager.net
TECRA <i>E. coli</i> O157 VIA [Used to detect <i>E. coli</i> O157 including <i>E. coli</i> O157:H7]	ELISA	20 h	International BioProducts Contact: Mike Yeager 14780 NE 95th St. Redmond, WA 98052 Phone: 800/729-7611 425/883-1349 E-mail: myeager@intlbioproducts.com Web: www.intlbioproducts.com
Transia Card <i>E. coli</i> O157	ELISA	24 h	Diffchamb AB FO Petersons Gata 32 SE-421 31 Västra Frölunda, Sweden Phone: +46 -31-742 33 50 E-mail: market.dept@diffchamb.se Web: www.diffchamb.se
Transia Plate <i>E. coli</i> O157	ELISA	22 h	Diffchamb AB FO Petersons Gata 32 SE-421 31 Västra Frölunda, Sweden Phone: +46 -31-742 33 50 E-mail: market.dept@diffchamb.se Web: www.diffchamb.se
VIDAS ECO [Used to detect <i>E. coli</i> O157]	Enzyme linked fluorescent assay	24 h	bioMérieux Inc. Contact: bioMérieux Industry 595 Anglum Rd. Hazelwood, MO 63042 Phone: 314/731-8500 E-mail: usa@na.biomerieux.com Web: www.biomerieux.com
VIDAS ICE [Used to detect <i>E. coli</i> O157]	Immunoconcentration	24 h	bioMérieux Inc. Contact: bioMérieux Industry 595 Anglum Rd

			Hazelwood, MO 63042 Phone: 314/731-8500 E-mail: usa@na.biomerieux.com Web: www.biomerieux.com
VIP for EHEC ² [Used to detect <i>E. coli</i> O157:H7]	Lateral Flow Immunoassay	18 h	BioControl Systems, Inc. Contact: Robin Forgey 12822 SE 32nd St. Bellevue, WA 98005 Phone: 800/245-0113; 425/603-1123 E-mail: info@rapidmethods.com Web: www.rapidmethods.com
VTEC-RPLA TD960 [Used to detect <i>E. coli</i> verotoxins VT1 and VT2]	Reversed passive latex agglutination	48 h (bacterial culture)	Oxoid, Inc. Contact: Jim Bell 217 Colonnade Rd. Nepean, Ontario K2E 7K3 Canada Phone: 613/226-1318 E-mail: jbell@oxoid.ca

¹Includes enrichment

²AOAC Approved

Commercial test products for *E. coli* enterotoxin

Test Kit	Analytical Technique	Approx. Total Test Time ¹	Supplier
VET-RPLA TD920 [Used to identify <i>E. coli</i> heat-labile enterotoxin]	Reversed passive latex agglutination	24 h (bacterial culture)	Oxoid, Inc. Contact: Jim Bell 217 Colonnade Rd. Nepean, Ontario K2E 7K3 Canada Phone: 613/226-1318 E-mail: jbell@oxoid.ca

¹Includes enrichment

²AOAC Approved

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