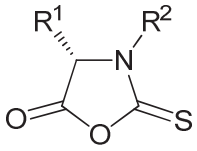
wherein:

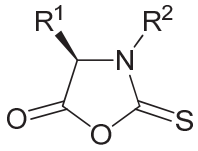
R^1 is alkyl, alkenyl, alkynyl, aryl, alkaryl, aralkyl, heteroalkyl, heteroalkenyl, heteroalkynyl, heteroaryl, or an amino acid side chain, and

R^2 is a hydrogen atom, alkyl, alkenyl, alkynyl, aryl, alkaryl, aralkyl, heteroalkyl, heteroalkenyl, heteroalkynyl, or heteroaryl.

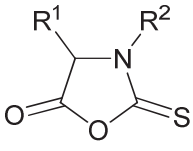
[5] Furthermore, disclosed herein are methods of acylating a nucleophile comprising contacting said nucleophile with a compound of Formula (I) in the presence of one or more Lewis acids and one or more bases. In some examples, the compound of Formula (I) is a compound of Formula (Ia) or (Ib):

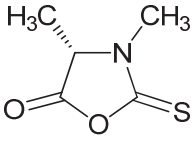


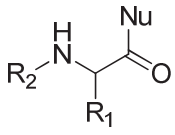
(Ia)

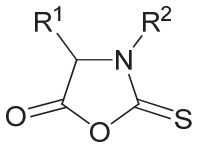


(Ib)

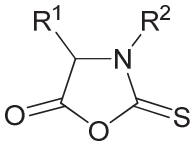
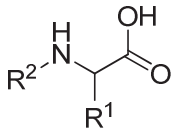
wherein R^1 and R^2 are as defined above. In certain examples, the methods provide an amino acid coupled product that is stereomerically pure. In one aspect, the present invention refers to a compound of Formula (I) 

(I) wherein R_1 is methyl and R_2 is methyl. In another aspect, the present invention refers to a compound of Formula (Iaa) 

(Iaa) wherein the compound is stereomerically pure. In yet another aspect, the present invention refers to a method of preparing a compound of Formula (II) 

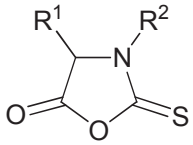
(II) comprising contacting a compound of Formula (I) 

(I) with a nucleophile in the presence of one or more Lewis acids and one or more bases, wherein R^1 is methyl, R^2 is methyl, and Nu is an appended portion of the nucleophile, to form the compound of Formula (II). In a further aspect, the present invention refers to a method of preparing a compound of

Formula (I)  (I) wherein R_1 is methyl, and R_2 is methyl, comprising contacting a compound of Formula (III)  (III) with 1,1′-thiocarbonyldiimidazole in the presence of one or more bases.

DETAILED DESCRIPTION

[6] Provided herein are compounds of Formula (I):



(I)

wherein:

R^1 is alkyl, alkenyl, alkynyl, aryl, alkaryl, aralkyl, or an amino acid side chain containing at least one carbon, and

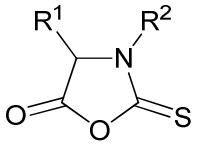
R^2 is a hydrogen atom, alkyl, alkenyl, alkynyl, aryl, alkaryl, or aralkyl.

[7] Furthermore, provided herein are processes for acylating a nucleophile comprising contacting said nucleophile with a compound of Formula (I) in the presence of one or more Lewis acids and one or more bases.

CLAIMS

We claim:

1. A compound of Formula (I):



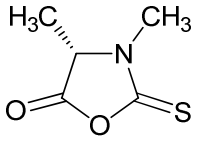
(I)

wherein:

R^1 is methyl and

R^2 is methyl.

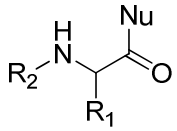
2. A compound of Formula (Iaa):



(Iaa)

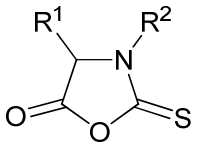
wherein the compound is stereomerically pure.

3. A method of preparing a compound of Formula (II):



(II)

comprising contacting a compound of Formula (I):



(I)

with a nucleophile in the presence of one or more Lewis acids and one or more bases,

wherein:

R^1 is methyl,

R^2 is methyl, and

Nu is an appended portion of the nucleophile,

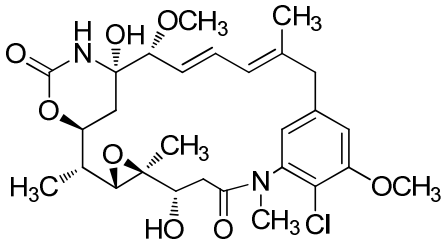
to form the compound of Formula (II).

4. The method of claim 3, wherein nucleophile is an alcohol.

5. The method of claim 3, wherein the nucleophile is a compound having the formula R^A-OH, wherein R^A is alkyl, alkenyl, alkynyl, alkaryl, aralkyl, aryl, heteroalkyl, heteroalkenyl, heteroalkynyl, or heterocycloalkyl.

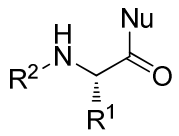
6. The method of any of claims 3-4, wherein the nucleophile is a maytansinoid having a C-3 hydroxyl group.

7. The method of any of claims 3-4, wherein the nucleophile is a compound of Formula (IV):



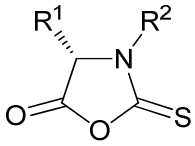
(IV).

8. The method of any of claims 3-7, wherein the compound of Formula (II) is a compound of Formula (IIa):



(IIa)

and the compound of Formula (I) is a compound of Formula (Ia):



(Ia),

wherein the compounds of Formula (Ia) and (IIa) are stereomerically pure.

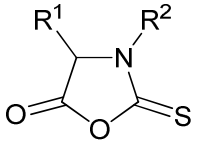
9. The method of any of claims 3-8, wherein the one or more Lewis acids are selected from the group consisting of $Zn(OTf)_2$, AgOTf, $Sc(OTf)_3$, $Cu(OTf)_2$, $Fe(OTf)_2$, $Ni(OTf)_2$, or $Mg(OTf)_2$.

10. The method of any of claims 3-9, wherein the one or more bases are selected from the group consisting of triethylamine, tributylamine, diisopropylethylamine, 1,8-diazabicycloundec-7-ene, and 2,6-di-tert-butylpyridine.

11. The method of any of claims 3-10, wherein the method is performed in a diluent comprising one or more polar aprotic solvents selected from the group consisting of diethyl ether, tetrahydrofuran, N,N-dimethylformamide, 2-methyltetrahydrofuran, 1,4-dioxane, and N,N-dimethylacetamide.

12. The method of any of claims 8-11, wherein the compound of Formula (Ia) prepared has an enantiomeric excess of at least 95%.

13. A method of preparing a compound of Formula (I):



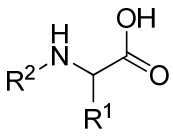
(I)

wherein:

R_1 is methyl, and

R_2 is methyl,

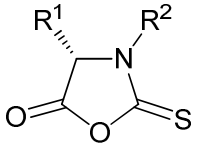
comprising contacting a compound of Formula (III):



(III)

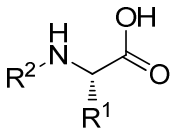
with 1,1′-thiocarbonyldiimidazole in the presence of one or more bases.

14. The method of claim 13, wherein the compound of Formula (I) is a compound of Formula (Ia):



(Ia)

and the compound of Formula (III) is a compound of Formula (IIIa):



(IIIa)

wherein the compound of Formula (IIIa) is stereomerically pure.